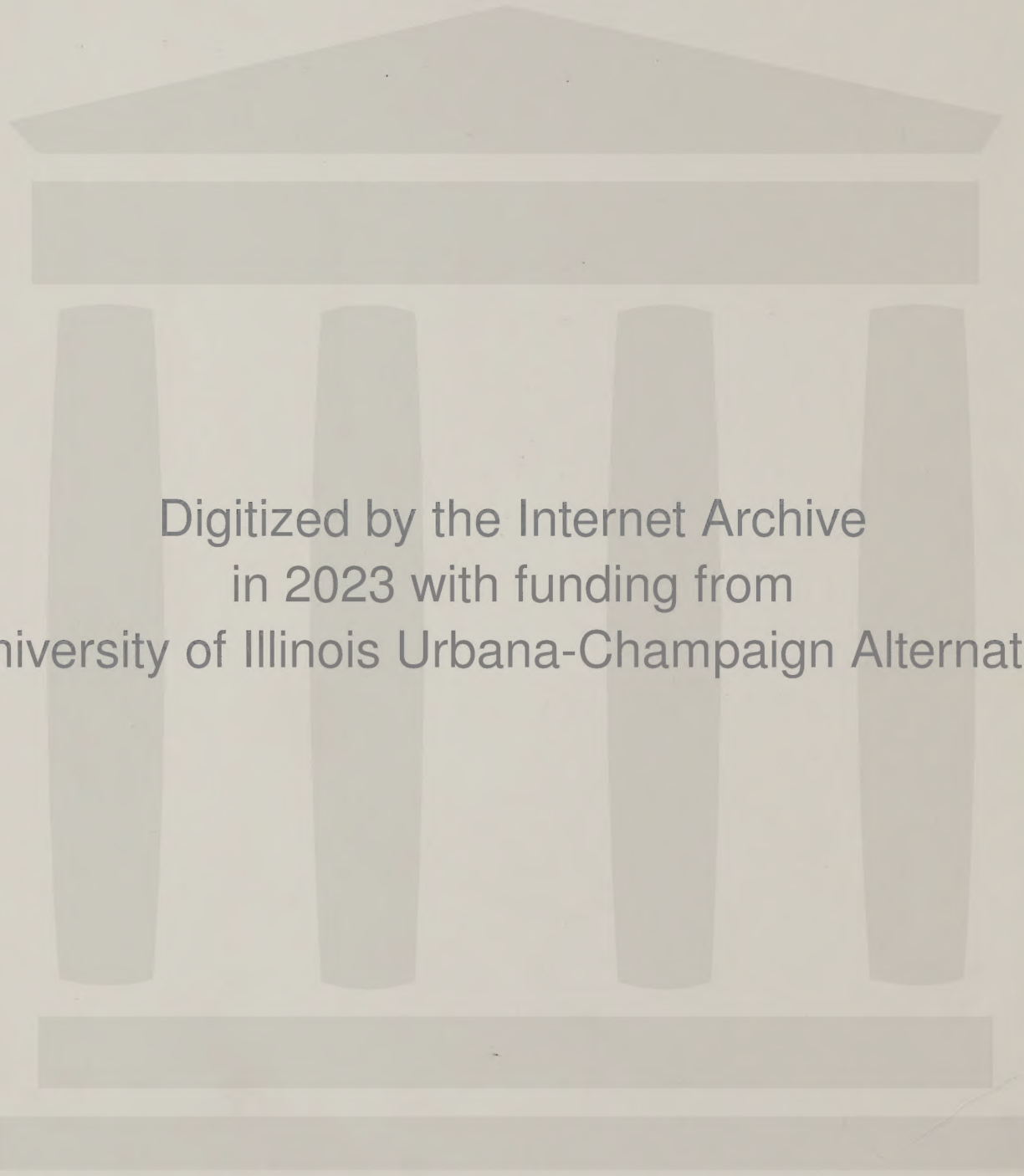


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A MONOGRAPH OF THE
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FLORA

OF THE

CARBONIFEROUS OF THE NETHERLANDS

AND

ADJACENT REGIONS

BY

Dr. W. J. JONGMANS

VOL. I

A MONOGRAPH OF THE CALAMITES
OF WESTERN EUROPE

BY

Dr. R. KIDSTON, F. R. S. L. AND E., F. G. S. AND Dr. W. J. JONGMANS

TEXT

PART I

UITGEGEVEN OP LAST VAN HET MINISTERIE VAN LANDBOUW, NIJVERHEID EN HANDEL

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This part contains the description of the species of the Genus *Calamites*.

The second part: the description of the species of the Genus *Asterocalamites*, the introduction and the general remarks on distribution etc. will be published as soon as possible after the end of the european war.

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CALAMITES SUCKOW.

STEMS.

- 1784 *Calamites* SUCKOW, Act. Hist. et Comm. Ac. elect. scient. et eleg. litter. Theod. Pal., V, p. 355, 357.
- 1820 *Calamites* SCHLOTHEIM, Petrefactenkunde, p. 398.
- 1828 *Calamites* BGT., Histoire, I, p. 121.
- 1828 *Calamites* BGT., Prodome, p. 37.
- 1851 *Calamites* ETTINGSHAUSEN, in HAIDINGER's Naturw. Abh., IV, 1, p. 72.
- 1869 *Calamites* GRAND' EURY, Compt. Rend. Ac. Sc. Paris, LXVIII, p. 705—709.
- 1869 *Calamites* GRAND' EURY, Ann. and Mag. Nat. Hist., (4), IV, p. 124—127.
- 1869 *Calamites* DAWSON, Ann. and Mag. Nat. Hist., (4), IV, p. 272.
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- 1884 *Calamites* WEISS, Steink. Calam., II, Abhandl. z. Geol. Specialk., V, 2, p. 1 (87)—58 (144).
- 1887 *Calamites* STUR, Calam. Schatzl. Schichten, Abhandl. k.k. Geol. Reichsanst., Wien, XI, II, p. 1—240.
- 1888 *Calamites* ZEILLER, Valenciennes, Text, p. 321.
- 1818 *Phytolithus* STEINHAEUSER, (*pars*), Trans. Amer. Phil. Soc., N. S., I, p. 265—297.
- 1832 *Calamitea* COTTA, (*pars*), Die Dendrol., p. 67 (69).
- 1834 *Hippurites* L. et H., Fossil Flora, II, p. 87.
- 1834 *Cyclocladia* L. et H., Fossil Flora, II, p. 137.
- 1899 *Cyclocladia* WHITE, Missouri, U. S. Geol. Surv. Monogr., XXXVII, p. 166.
- 1849 *Calamodendron* BGT., Tableau, p. 50.
- 1864—65 *Calamodendron* GOEPPERT, Palaeontogr., XII, p. 180.
- 1855 *Equisetites* GEINITZ, (*pars*), Sachsen, p. 3.
- 1864—65 *Arthropitys* GOEPPERT, Palaeontogr., XII, p. 183.
- 1869 *Macrostachya* SCHIMPER, (*pars*), Traité, I, p. 333.
- 1869 *Calamophyllites* GRAND' EURY, Compt. Rend. Ac. Sc. Paris, LXVIII, p. 708 (705—709).
- 1888 *Calamophyllites* ZEILLER, Valenciennes, p. 359.
- 1869 *Calamopitys* WILLIAMSON, (*non* UNGER), Mem. Lit. and Phil. Soc., Manchester, (3), IV, p. 155—183 (p. 174!).
- 1876 *Calamitina* WEISS, Steink. Calam., I, Abhandl. z. Geol. Specialk., II, 1, p. 117, 126—127.
- 1884 *Calamitina* WEISS, Steink. Calam., II, Abhandl. z. Geol. Specialk., V, 2, p. 55 (141), 59—61 (145—147).
- 1877 *Calamodendrofluyos* GRAND' EURY, Loire, p. 291, 293.
- 1877 *Calamodendroxylon* GRAND' EURY, Loire, p. 29.
- 1877 *Endocalamites* GRAND' EURY, Loire, p. 34.
- 1877 ? *Biotocalamites* GRAND' EURY, Loire, p. 332, 333 (no description).
- 1884 *Eucalamites* WEISS, Steink. Calam., II, Abhandl. z. Geol. Specialk., V, 2, p. 55 (141), p. 96 (182)—98 (184).

- 1884 *Stylocalamites* WEISS, Steink. Calam., II, Abhandl. z. Geol. Specialk., V, 2, p. 56 (142), p. 119 (205).
 1885 *Equisetum* REN. et ZEILLER (non LINN.), Compt. Rend. Ac. Sc. Paris, C, p. 71.
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 1901 *Equisetum* STEFANI (non LINN.), Flore carbon. e perm. della Toscana, p. 72.
 1898 *Arthrodendron* SCOTT, in SEWARD, Fossil Plants, I, p. 302, 324, 325, 381.
 1900 *Arthrodendron* SCOTT, Studies, p. 32.
 1912 *Dictyocalamites* ARBER, Geolog. Magazine, Dec. V, IX, p. 97.
 1912 ? *Clautocalamites* GRAND'EURY, Recherches géobot. sur les forêts et sols fossiles, I, Livr. I, p. 21 (no description).

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- 1820 *Casuarinites* SCHLOTHEIM, (pars?), Petrefactenkunde, p. 397.
 1822 *Asterophyllites* BGT., Classification, Mém. Mus. Hist. Nat., Paris, VIII, p. 10 (210).
 1823 *Annularia* STERNBERG, Versuch, I, Fasc. 2, p. 28, 31, 32, 36; 1825, Fasc. 4, p. XXXI.
 1828 *Annularia* BGT., Prodrôme, p. 155.
 1823 *Schlotheimia* STERNBERG, Versuch, I, 2, p. 31, 32, 36.
 1825 *Bornia* STERNBERG, pars, Versuch, I, 4, p. XXVIII.
 1825 *Bruckmannia* STERNBERG, Versuch, I, 4, p. XXIX.
 1825 *Bechera* STERNBERG, Versuch, I, 4, p. XXX.
 1825 *Volkmannia* STERNBERG, Versuch, I, 4, p. XXIX.
 1860 *Trochophyllum* WOOD, Proc. Acad. Nat. Sci. Philad., p. 438.
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 1911 *Calamocladus* THOMAS, Phil. Trans. Roy. Soc. London, B, CCII, p. 51–92.
 1876 *Paracalamostachys* WEISS, Steink. Calam., I, Abh. z. geol. Specialk., II, 1, p. 49.
 1884 *Paracalamostachys* WEISS, Steink. Calam., II, Abh. z. geol. Specialk., V, 2, p. 190 (276).
 1876 *Palaeostachya* WEISS, Steink. Calam., I, Abh. z. geol. Specialk., II, 1, p. 103–105.
 1884 *Palaeostachya* WEISS, Steink. Calam., II, Abh. z. geol. Specialk., V, 2, p. 181 (267).
 1876 *Stachannularia* WEISS, Steink. Calam., I, Abh. z. geol. Specialk., II, 1, p. 1–17.
 1869 *Calamostachys* SCHIMPER, Traité, I, p. 328.
 1876 *Calamostachys* WEISS, Steink. Calam., I, Abh. z. geol. Specialk., II, 1, p. 32–38.
 1884 *Calamostachys* WEISS, Steink. Calam., II, Abh. z. geol. Specialk., V, 2, p. 161.
 1871 *Cingularia* WEISS, Foss. Fl. d. jüngst. Steink. u. Rothl., p. 138.
 1837 *Huttonia* STERNBERG, Verhandl. d. Gesellsch. d. Vaterl. Museums in Böhmen, p. 19.
 1880 *Asterophyllum* SCHIMPER, in Zittel, Handbuch, II, 2, p. 175.
 1890 *Calamodendrostachys* RENAULT, Commentry, p. 471.
 1896 *Calamodendrostachys* RENAULT, Flore d'Autun et d'Épinac, II, p. 130.
 1896 *Arthropityostachys* RENAULT, Flore d'Autun et d'Épinac, II, p. 133.
 1901 *Aspasia* STEFANI, Flore carb. e perm. della Toscana, p. 73.

ROOTS.

- 1825 *Myriophyllites* ARTIS, Antedil. Phytol., p. 12.
 1825 *Hydatica* ARTIS, (pars), Antedil. Phytol., p. 1.
 1878 *Astromylon* WILLIAMSON, On the Organization, IX, Phil. Trans. Roy. Soc. London, CLXIX, p. 319.
 1881 *Myriophylloides* CASH, Proc. Yorksh. Geol. and Polyt. Soc., VII, 4, p. 400.
 1881 *Helophyton* WILLIAMSON, Nature, Dec. 8, p. 124.

DESCRIPTION.

Outer surface.

Smooth, with fine longitudinal fibrillous striation or reticulate ornamentation, often with transverse wrinkling and on older stems longitudinal cracks.

Branch scars large, circular, oval, semicircular or quadrate, approximate or distant, often deformed by mutual pressure, placed above or below the nodal line. Umbilicus central or eccentric, circular. Branch scars may occur on every node or periodic, verticillate, or irregularly scattered on the stem.

Leaf scars small, elliptical, circular or quadrate from mutual pressure, separate or approximate or joined together by a connecting band or by their elongated points and so form a chain-like band along the nodal line.

Stem leaves setaceous, or lanceolate, with sometimes expanded bases by which they are united, single veined.

Pith cast.

Internodes of varying length and width. Often contracted at the nodes, ribbed, ribs straight or flexuous, flattened, rounded or with a dorsal angular ridge, divided by furrows which in some species are bordered by a distinct line on each margin. Oval, round or elongate tubercles occur at the upper ends of the ribs and sometimes small punctiform ones at their lower ends. Especially the tubercles at the lower ends but also those at the upper ends are sometimes not visible.

Surface of ribs smooth or longitudinally striated, often with transverse striae, and in some cases cross-hatched, or with a cellular or granular ornamentation. Terminations of ribs blunt, or more or less sharp pointed. Ribs usually alternating at the nodes but in many cases numerous ribs pass straight over one or more nodes.

Branch scars placed upon the nodal line, circular or their position only indicated by the convergence of some of the ribs from the neighbouring internodes to a point on the nodal line. Exceptionally (in a very few species), no convergence of the ribs towards the branch scars takes place.

In addition to the branch scars, large stem scars can also be observed on some species.

Rhizomatic portions known in only a few species and with a general habit somewhat similar to that of the aerial stems.

Root scars verticillate, often occurring on each node or more or less irregular distributed over the rhizome or occurring in a scattered manner and in small numbers.

In addition to the root scars, verticils of branch scars can be present on the rhizome in the transitional region between aerial stem and rhizome.

On outer surface of rhizome the root scars are circular and frequently very large.

Plants generally attaining arborescent dimensions. Stems arise from other aerial stems or from rhizomes. In connection with the rhizomes resting tubers have been found.

Roots.

Roots circular in section but always flattened on the impressions, in some cases bearing numerous rootlets scattered over the whole of their surface. (*Myriophyllites* of ARTIS.)

Foliage and Fructification.

Stems with leaves attached or isolated verticils of stem leaves have frequently been described as *Equisetites*. Branch foliage of the type of *Asterophyllites* and *Annularia*.

Fructification in the form of cones.

CALAMITES UNDULATUS STERNB.

Pl. 1—23; Pl. 24, fig. 1, 2, 3; Pl. 25—28; Pl. 29, fig. 1, 2; Pl. 30; Pl. 31, fig. 1, 2, 3, (4,) 5;
 Pl. 32—37; Pl. 38, fig. 1; Pl. 39, fig. 1; Pl. 44, fig. 1; Pl. 47, fig. 7; Pl. 48, fig. 1;
 Pl. 50, fig. 5; Pl. 51, fig. 1; Pl. 137, fig. 3; Pl. 157, fig. 5; Text fig. 1—19.

SYNONYMY.

- 1825 *Calamites undulatus* STERNBERG, Versuch, I, Fasc. 4, p. 26; II, 1833, Fasc. 5, 6, p. 47, Pl. 1, fig. 2; Pl. 20, fig. 8.
- 1828 *Calamites undulatus* BGT., Histoire, I, Livr. 2, p. 127, Pl. 17, fig. 1—4.
- 1835 *Calamites undulatus* GUTBIER, Zwickau, p. 18, Pl. 2, fig. 5, 5a.
- 1845 *Calamites undulatus* UNGER, Synopsis, p. 21.
- 1848 *Calamites undulatus* GOEPPERT, in Bronn, Index, p. 200.
- 1848 *Calamites undulatus* SAUVEUR, Belgique, Pl. 5, fig. 1—3; Pl. 8, fig. 1.
- 1850 *Calamites undulatus* UNGER, Gen. et species, p. 45.
- 1860 *Calamites undulatus* LESQUEREUX, Second Rept. Geol. Survey of Arkansas, p. 312, Pl. 4, fig. 7, 7a.
- 1873 *Calamites undulatus* DAWSON, Rept. on the fossil plants of the Lower Carboniferous and Millstone Grit Formations of Canada, p. 30, Pl. 8, fig. 68, (?66, 67, 69), (non 70—73).
- 1882 *Calamites undulatus* ACHEPOHL, Niederrh. Westf. Steink., Lief. 5—7, p. 88, Pl. 27, fig. 14.
- 1886 *Calamites undulatus* ZEILLER, Valenciennes, Atlas, Pl. 54, fig. 1, 4; Text, 1888, p. 338.
- 1888 *Calamites undulatus* SEWARD, Geol. Magazine, Dec. III, Vol. V, p. 289, Pl. 9.
- 1888 *Calamites undulatus* DAWSON, The geol. hist. of plants, p. 168.
- 1892 *Calamites undulatus* ZEILLER, Brive, p. 59.
- 1904 *Calamites (Calamitina) undulatus* ARBER, North West Devon, Phil. Trans. Roy. Soc. London, B, Vol. CXCVII, p. 301, Pl. 19, fig. 1, 3.
- 1910 *Calamites undulatus* RENIER, Docum. Paléont. terr. houiller, p. 17, Pl. 44.
- 1911 *Calamites undulatus* JONGMANS, Beitr. zur Kenntn. von *C. undulatus*. Mededeel. van 's Rijks Herbarium, No. 2, p. 43, 59, fig. 1—11.
- 1911 *Calamites undulatus* JONGMANS, Anleitung, I, Mededeel. Rijks Opsporing van Delfstoffen, No. 3, p. 66, fig. 70—72.
- 1911 *Calamites undulatus* KIDSTON, Hainaut, Mém. Mus. Roy. d'Hist. nat. Belgique, IV, p. 107.
- 1912 *Calamites undulatus* ZALESSKY, Bull. de la Société russe d'amis d'études de l'Univers, 1912, No. 2, p. 5, fig. 4.
- 1912 *Calamites undulatus* VERNON, Q. J. G. S., London, LXVIII, p. 637, Pl. 57, fig. 3.
- 1912 *Calamites undulatus* GROOM, Journ. Linn. Society, Botany, XL, p.p. 493, 495, Curve 3.
- 1913 *Calamites undulatus* JONGMANS and KUKUK, Calam. Rhein. Westf. Steink., Mededeel. van 's Rijks Herbarium, Leiden, No. 20, p. 10, Pl. 1—7; Pl. 8, fig. 1.
- 1889 *Stylocalamites undulatus* KIDSTON, Ravenhead, Trans. Roy. Soc. Edinb., XXXV, p. 401.
- 1894 *Calamitina undulata* KIDSTON, South Wales, Trans. Roy. Soc. Edinb., XXXVII, p. 580.

- 1884 *Calamites suckowi* var. *undulatus* WEISS, Steink. Calam., II, p. 129, 134, 135, Pl. 17, fig. 4.
- 1907 *Calamites suckowi* var. *undulatus* STERZEL, Karbon und Rothlieg. im Grossherzogtum Baden, Mitt. Grossh. Badischen geol. Landesanstalt, V, p. 430, Pl. 19, fig. 1.
- 1825 *Bambusoides abnormis* KOENIG, Icones foss. sect., Pl. 16, fig. 198.
- 1828 *Calamites nodosus* BGT., (pars), Histoire, I, p. 133, Pl. 23, fig. 3, (non fig. 2, 4).
- 1822 *Calamites decoratus* BGT., Classification, Mém. du Mus. Hist. nat., Paris, VIII, p. 17 (217), Pl. 1 (12), fig. 2.
- 1828 *Calamites decoratus* BGT., (pars), Histoire, I, p. 123, Pl. 14, fig. 3, 4, (non fig. 1, 2).
- 1828 *Calamites decoratus* BISCHOFF, Kryptog. Gewächse, p. 51, 60, Pl. 6, fig. 11.
- 1854 *Calamites decoratus* MANTELL, Medals of Creation, 2nd Edition, p. 107, fig. 14.
- 1828 *Calamites suckowi* BGT., (pars), Histoire, I, p. 124, Pl. 15, fig. 1, (? 2, 3, 4, 5).
- 1855 *Calamites suckowi* GEINITZ, (pars), Sachsen, p. 6, Pl. 13, fig. 4.
- 1881 *Calamites suckowi* ACHEPOHL, (pars), Niederrh. Westf. Steink., p. 68, Pl. 20, fig. 6.
- 1887 *Calamites suckowi* STUR, (pars), Calam. Schatzl. Schichten, p. 145, Pl. 14, fig. 1; (? Pl. 1, fig. 3).
- 1907 *Calamites suckowi* STERZEL, Karbon und Rothlieg. im Grossherzogtum Baden, Mitt. Grossh. Badischen geol. Landesanstalt, V, p. 708, Pl. 57, fig. 2a, (non b—e).
- 1911 *Calamites suckowi* JONGMANS, (pars), Anleitung, I, p. 169, fig. 141.
- 1828 *Calamites cannaeformis* BGT., (pars), Histoire, I, p. 131, Pl. 21, fig. 2, 3.
- 1833 ? *Calamites cannaeformis* L. et H., Fossil Flora, I, p. 217, Pl. 79.
- 1835 *Calamites cannaeformis* GUTBIER, Verst. Zwick. Schwarzk., p. 22, Pl. 2, fig. 7.
- 1868 *Calamites cannaeformis* VON ROEHL, (pars), Westphalen, Palaeontogr., XVIII, p. 12, Pl. 2, fig. 3.
- 1874 *Calamites cannaeformis* FEISTMANTEL, (pars), Böhmen, p. 109, Pl. 7, fig. 3; Pl. 8, (? fig. 1), fig. 2.
- 1899 *Calamites cannaeformis* HOFMANN and RYBA, Leitpflanzen, p. 25, Pl. 1, fig. 7.
- 1828 *Calamites pachyderma* BGT., Histoire, I, p. 132, Pl. 22.
- 1828 *Calamites approximatus* BGT., (pars), Histoire, I, p. 133, Pl. 24, fig. 1.
- 1848 ? *Calamites approximatus* SAUVEUR, Belgique, Pl. 2.
- 1855 *Calamites approximatus* GEINITZ, (pars), Sachsen, p. 7, Pl. 11, fig. 3.
- 1833 *Calamites varians* STERNBERG, Versuch, Vol. II, Fasc. 5, 6, p. 50, Pl. 12.
- 1847 *Calamites varians* GERMAR, Wettin und Löbejün, Heft IV, p. 47, Pl. 20, fig. 1, (fig. 2, 3 see remarks).
- 1868 *Calamites varians* VON ROEHL, Westphalen, Palaeontogr., XVIII, p. 14, Pl. 1, fig. 1.
- 1870 *Calamites varians* WEISS, Foss. Fl. jüngst. Steink., Pl. 13, fig. 7, (non fig. 1, 2).
- 1881 *Calamites varians* WEISS, Aus d. Steinkohlenf., p. 10, Pl. 7, fig. 41 (Same fig. in the second edition, 1882).
- 1883 *Calamites varians* ACHEPOHL, Niederrh., Westf. Steink., Erg. Blatt II, fig. 24.
- 1883 *Calamites varians* SCHENK, (pars), in RICHTHOFEN, China, Vol. IV, p. 234, Pl. 35, fig. 1, (non Pl. 34, fig. 1).
- 1892 *Calamites varians* ZEILLER, Brive, p. 63, Pl. 11, fig. 1.
- 1899 *Calamites (Calamitina) varians*, HOFMANN and RYBA, (pars), Leitpflanzen, p. 23, Pl. 1, fig. 2, (non fig. 1).
- 1911 *Calamites varians* JONGMANS, Anleitung, I, p. 74, fig. 73.
- 1912 *Calamites varians* ARBER, (pars), Forest of Dean, Trans. Roy. Soc., London, B. CCII, p. 240, Pl. 13, fig. 16, (non fig. 15).
- 1884 *Calamites varians inconstans* WEISS, (pars), Steink. Calam., II, p. 69. Text fig. on p. 71.
- 1884 *Calamites varians insignis* WEISS, (pars), Steink. Calam., II, p. 62, 63, Pl. 1, fig. 1; Pl. 28, fig. 1; (non Pl. 1, fig. 2—6).
- 1911 *Calamites varians insignis* JONGMANS, (pars), Anleitung, I, p. 75, fig. 76, (non fig. 75, 77, 77a, 78).
- 1838 *Calamites alternans* GERMAR, in Isis, Pl. 3, fig. 1. (non Act. Ac. Leop. Car. Nat. Cur., XV, 2, 1831, p. 221, Pl. 65, fig. 1).

- 1854 *Calamites communis* ETTINGSHAUSEN, (*pars*), Radnitz, p. 24, Pl. 3, fig. 1, 3; Pl. 4, fig. 1, 3.
 1868 *Calamites communis* FEISTMANTEL, (*pars*), Abh. k. Böhm. Ak. d. Wiss, (6), II, Pl. 1, fig. D, E, (*non A*).
 1868 *Calamites roemeri* VON ROEHL (*non* GOEPP.), Westphalen, Palaeontogr., XVIII, p. 15, Pl. 1, fig. 7.
 1868 *Calamites ramosus* VON ROEHL (*non* ARTIS), (*pars*), Westphalen, Palaeontogr., XVIII, p. 10, Pl. 1, fig. 4.
 1882 *Calamites major* ACHEPOHL (*non* WEISS), Niederrh. Westf. Steink., p. 74, Pl. 22, fig. 7, 8.
 1883 *Calamites duplex* ACHEPOHL, l. c., p. 135, Pl. 41, fig. 11.
 1883 *Calamites inaequus* ACHEPOHL, l. c., p. 134, Pl. 34, fig. 15.
 1883 *Calamites intumescens* ACHEPOHL, l. c., p. 118, Pl. 36, fig. 7.
 1876 *Calamites acuticostatus* WEISS, Steink. Calam., I, p. 125, Pl. 19, fig. 2; II, 1884, p. 137.
 1911 *Calamites acuticostatus* JONGMANS, Anleitung, I, p. 184, fig. 152, 152a.
 1887 *Calamites schulzi* STUR, (*pars*), Calam. Schatzl. Schicht., p. 72, Pl. 7b, fig. 2; Pl. 14b, fig. 1; (? Pl. 6, fig. 3; Pl. 7, fig. 1, 3).
 1887 *Calamites schützei* STUR, (*pars*), Calam. Schatzl. Schichten, p. 131, Pl. 4, fig. 2, 3; Pl. 4b, fig. 1 (to this text fig. 38 on p. 143).
 1910 *Calamites schützei* RENIER, Docum. Paléont. Terr. houill., Pl. 39.
 1887 *Calamites schatzlarensis* STUR, (*pars*), Calam. Schatzl. Schichten, p. 164, Pl. 1, fig. 1, 2; (*non* Pl. 13, fig. 10, 11; Pl. 14b, fig. 4).
 1911 *Calamites schatzlarensis* JONGMANS, (*pars*), Anleitung, I, p. 170, fig. 147, 148.
 1887 *Calamites sachsei* STUR, (*pars*), Calam. Schatzl. Schichten, p. 180, Pl. 2b, fig. 1; (? Pl. 3, fig. 1).
 1888 ? *Arthropitys gigas* RENAULT (*non* BGT.), Commentry, II, Atlas, Pl. 52, fig. 4; Pl. 53, fig. 3, 4; Pl. 55, fig. 1, 2; Pl. 56, fig. 1; Pl. 57, fig. 1; Text, 1890, p. 436.
 1898 *Arthropitys gigas* RENAULT (*non* BGT.), Notice sur les Calamariées, III, Bull. Soc. hist. nat. Autun, XI, p. 41, 42, Pl. 7bis, fig. 1; (*non* Pl. 9, fig. 5, 6).
 1888 *Arthropitys bistriata* RENAULT, (*non* COTTA), Commentry, II, Atlas, Pl. 52, fig. 3; (*non* Pl. 52, fig. 5); Text, 1890, p. 429.
 1888 *Arthropitys stephanensis* RENAULT, Commentry, II, Atlas, Pl. 54, fig. 1; Text, 1890, p. 445.
 1898 *Arthropitys stephanensis* RENAULT, Notice sur les Calamariées, III, Bull. Soc. Hist. nat. Autun, XI, Pl. 7, fig. 1.
 1911 *Calamites (Arthropitys) stephanensis* JONGMANS, Anleitung, I, p. 97, fig. 95.
 1892 *Calamites leioderma* ZEILLER, Brive, p. 60, Pl. 10, fig. 1–3.
 1911 *Calamites leioderma* JONGMANS, (*pars*), Anleitung, I, p. 190, fig. 157, 158.
 1910 *Calamites species* ARBER, Fossil Flora Yorkshire, Proc. of the Yorksh. Geol. Soc., XVII, 2, p. 144, Pl. 13, fig. 1, 2.
 1912 *Calamites species* GOTHAN, Aus d. Vorgeschichte der Pflanzenwelt, p. 85, fig. 49.
Calamites sinuatus GOLDENBERG, Manuscript in the Palaeobotanical Museum, Stockholm.
 1809 *Phytolithus etc.* MARTIN, Petrificata derbiensia, Pl. 51; Pl. 52, fig. 2.
 1818 *Phytolithus parmatus* STEINHAEUER, (*pars*), Trans. Amer. Phil. Soc., p. 286, Pl. 6, fig. 1, (*non* Pl. 7, fig. 1).
 1834 *Cyclocladia major* L. et H., Fossil Flora, II, Pl. 130.

DESCRIPTION.

Outer surface.

Surface almost smooth but ornamented with very fine longitudinal somewhat flexuous lines, which occasionally come in contact but do not form a net-like reticulation. Transverse wrinklins met with only rarely.

Internodes varying in length, shorter than broad, very rarely longer than broad.

Leaf scars transversely elliptical, with produced lateral margins which form a connecting longitudinally striated band.

Branch scars verticillate, transversely oval, approximate or sometimes slightly distant though generally touching each other laterally, placed above the nodal line upon which they press, and cause it to assume a sinuous course following the contour of the branch scars. Umbilicus eccentric, circular and surrounded by an oval depression.

Pith cast.

Internodes 1 to 12 cm. long or even more, those bearing the branch scars very short and with the exception sometimes of that immediately above the branch bearing internode, they regularly increase in length upwards until another branch scar verticil is met with. In some rare cases the internodes are all equally long with the exception of those which bear the branch scars which are always shorter.

Ribs flattened or somewhat arched, 1.5 to 5 mm. broad, divided by straight or flexuous prominent furrows. Ribs ending in rectangular points, upper surface ornamented by cross-hatching, which, when very distinctly preserved assumes the form of a net work of rectangular meshes. Tubercles at the upper ends circular or sometimes oval, seldom more than 1 mm. in diameter. Those at the lower ends are smaller, punctiform, but are not always present. When present they are generally very conspicuous.

Branch scars small, distant, verticillate, circular, placed on the nodal line and to which four or five of the ribs below and above them converge. They have a diameter of two to three mm. and are represented as depressions on the pith cast. Generally the succeeding verticils of scars are separated by a certain number of nodes which do not bear branch scars.

In addition to the branch scars just described large stem scars occasionally occur on the nodes. They are circular or subcircular and attain a diameter from 0.75 till over 4 cm.

Rhizomes.

Of the subterranean organs, the outer surface of large specimens only is known. They have a smooth bark with distant, large, irregularly placed, circular root scars with a central umbilicus situated on the node.

The subterranean stems and rhizomes generally show the same type as the aerial stems. The ribs are however usually narrower but possess the same type of ornamentation only it is restricted to the central area of the rib. Root scars are often found on the nodes of the subterranean portions. These are circular, usually smaller than the branch scars, sometimes arranged in regular verticils which may occur on succeeding nodes or be separated by some nodes on which none are present or they may be placed in a scattered and irregular manner.

Roots bear transverse wrinkles or are almost smooth with fine longitudinal striations.

Where a stem joins a subterranean part it is generally bent and ends in a conical point with much shortened internodes.

REMARKS.

I. *Nomenclature.*

The first question for consideration is the name to be adopted for the species which in recent years has been usually designated *Calamites undulatus*. It seems to be beyond all question that the plant figured by BRONGNIART in his Classification, Pl. 1, fig. 2 and more fully described and illustrated in the Histoire, Pl. 14, fig. 3—4 under the name of *Calamites decoratus* is specifically identical with the fossils to which the name of *Calamites undulatus* has been almost universally applied.

BRONGNIART's original specimen is fortunately still preserved in the Musée d'Hist. nat., Paris, and through the kindness of the Director, M. LECOMTE, we are able to reproduce it natural size on our Pl. 10, fig. 4 and an enlargement of a portion of the specimen is given at fig. 5. These two figures show the sharp pointed terminations of the ribs, their cross-hatching and the small terminal tubercles as well as the occasional occurrence of flexuous furrows which prove this specimen to be absolutely identical with the *Calamites undulatus* of authors.

BRONGNIART seems to have held the opinion that the essential specific character of *Calamites undulatus* was the flexuous ribs and the only specimens he figures under this name are small fragments of internodes which show this character in addition to the cross-hatching on their outer surface. (BRONGT., Histoire, Pl. 17, fig. 1, the original of which we have examined).

It is remarkable however that in the figure BRONGNIART gives of the *Calamites decoratus* the ribs are all drawn with straight dividing furrows whereas on the original some of them are distinctly flexuous. The figure given by BRONGNIART in his Classification is evidently a diagrammatic representation of the generic characters of *Calamites*.

In his Histoire, BRONGNIART reproduces the two figures given by ARTIS (Anted. Phytology, Pl. 24) under the name of *C. decoratus*. These are however referable to *Calamites suckowi*, with which they agree in the blunt terminations of the ribs with their large tubercles at the upper ends. ¹⁾

It is unfortunate that BRONGNIART adopted SCHLOTHEIM's name of *Calamites decoratus* for the specimens he described in his Classification as it is evident that it is quite impossible to identify *C. decoratus* SCHLOTHEIM (Petrefactenkunde, p. 401) with any given species and as ZEILLER points out, his description would apply to any member of the whole genus (Valenciennes, p. 341). We are therefore reluctantly compelled to reject the name of *Calamites decoratus* and to adopt that of *Calamites undulatus* STERNBERG for this widely distributed species.

¹⁾ *Cal. decoratus* BGT. must not be mistaken with the *Equisetites* or *Calamites decoratus* EICHWALD, Lethaea Rossica, I, p. 178, Pl. 13, fig. 5—10, which is altogether distinct from BRONGNIART's plant.

II. Outer surface.

In beginning the description of the numerous specimens of *Calamites undulatus* STERNBERG, which are illustrated in the present Memoir, it is best to begin with those examples which show the outer surface and the pith cast in organic union.

One such specimen is shown on Pls. 1 and 2 and at Text fig. 1; Pl. 2 being the upper half of the specimen and fits on to the upper margin of Pl. 1. Dealing first with the portion shown on Pl. 1, the upper part of the figure exhibits the impression of the smooth bark on the right hand of the fossil, whereas on the left side this is covered by the remains of the pith cast. On this portion of the specimen the bark is quite smooth but on Pl. 2, fig. 1, where a portion of the cast has been removed, the impression of the outer surface of the bark is there seen to be transversely wrinkled. These differences are probably due to varying conditions of preservation, but specimens showing the transverse wrinkles are much more rare than those with a smooth bark.

This specimen also shows one incomplete and two complete verticils of branch scars. These are separated from each other by 7 internodes in the one case and by 8 in the other. The distribution of the scar verticils and of the length of the intervening internodes is given in the diagram of this specimen (Text fig. 1).

The branch scars are oval or subcircular, slightly irregular in size and laterally pressed upon each other. The leaf scars are well seen on Pl. 2, fig. 1 on the left hand termination of the second node from the top and are enlarged at fig. 2 of the same plate. This figure shows very beautifully the transversely elongated leaf scars with a small central tubercle and the striated area which connects them together in a catenulate manner. The fine irregular vertical striation on the outer surface of the bark can also be seen on this figure.

The characteristic ribs with their undulating furrows are especially well exhibited on Pl. 2 towards the upper end of the fossil.

A well known example of *Calamites undulatus* which has already been figured by WEISS, GERMAR, SCHENK and HOFMANN and RYBA, (see Synonymy,) is reproduced on our Pl. 9, fig. 1, 2, 3 and Pl. 10, fig. 1, 2. Fig. 2, Pl. 9 is the impression of fig. 1 which fits on to the face of fig. 2. The outer surface of the bark is beautifully preserved and the ornamentation can be well seen on this figure if examined with a lens. Here the portion of the bark adhering to the cast exhibits three branch scars and on the cast six or seven ribs are seen on each side of the internode to converge to a little pit-like depression which indicates the position of a fourth branch scar. The part on which the fifth branch scar was placed as seen in fig. 2, is broken off from the cast. At fig. 3, Pl. 9 a few of the leaf scars are enlarged but except showing the striations on the connecting area they afford no details of their structure.

At fig. 1, 2, Pl. 10 two additional enlargements are given. That at fig. 1 shows one of the branch scars and on the cast, converging lines indicate the position of another branch scar. This figure also shows that some of the ribs do not alternate and as well as fig. 2, illustrates very clearly the ornamentation of the outer surface of the ribs. At

110 mm.

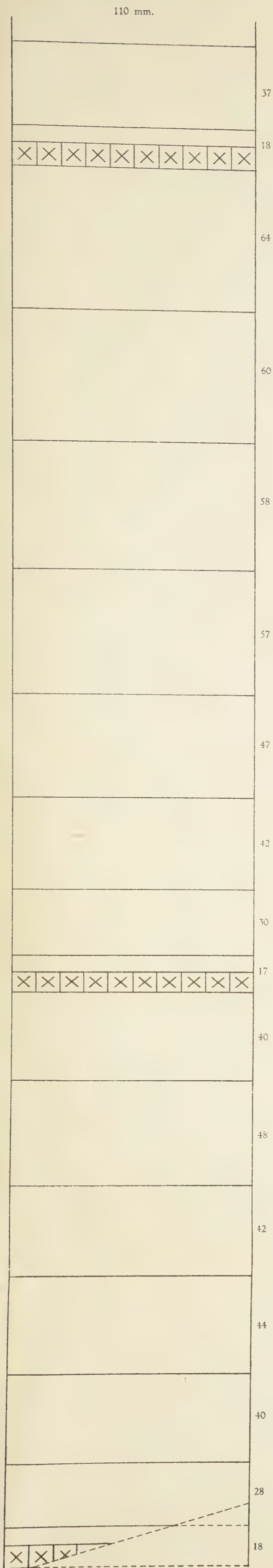
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	18
X X X X X X X X X X	
	64
	60
	58
	57

90 mm.

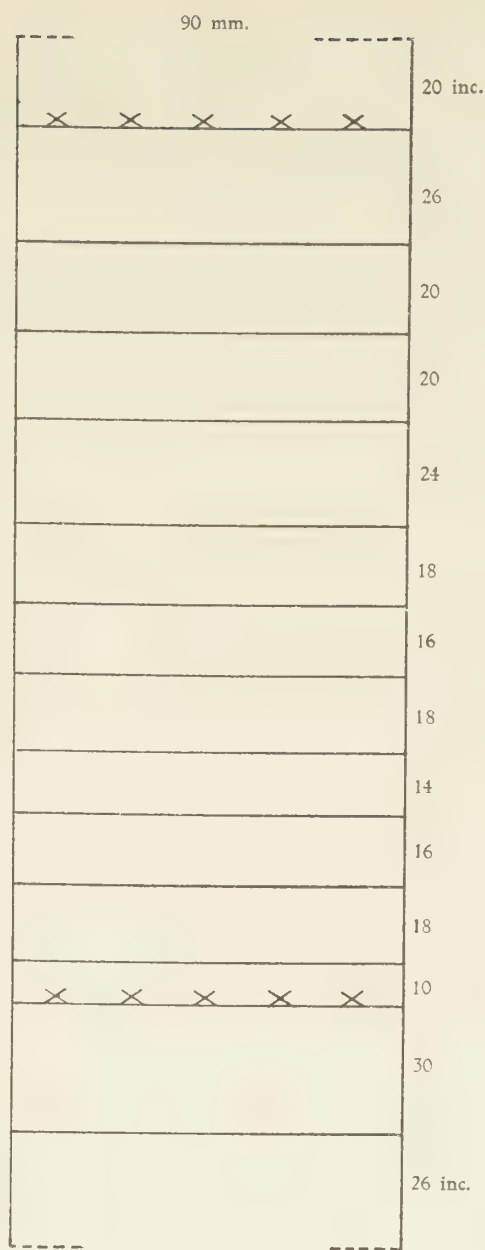
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	30
	26 inc.

95 mm.

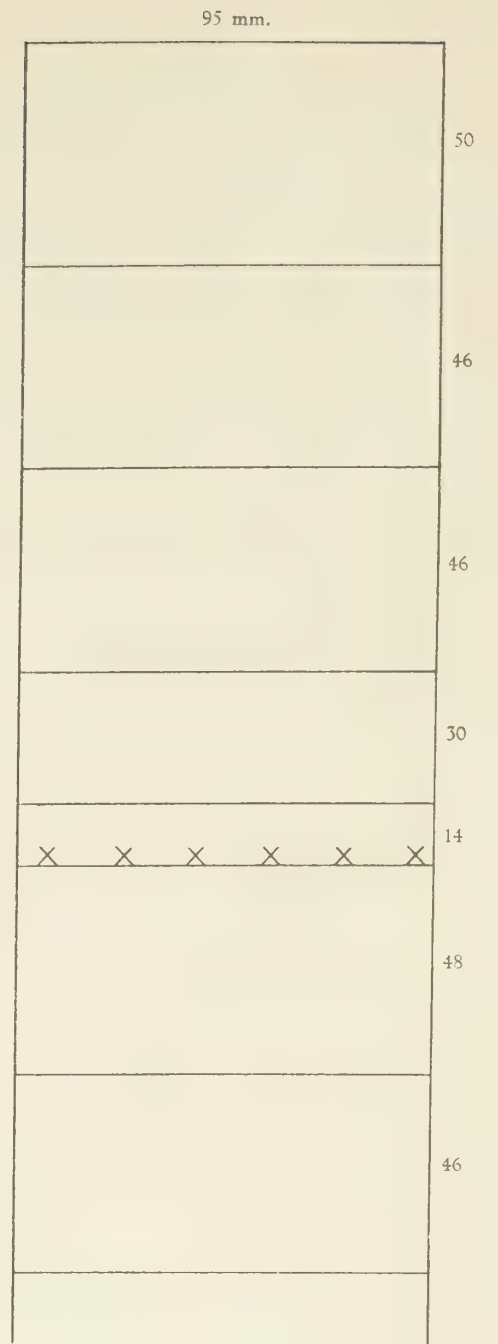
	50
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	46



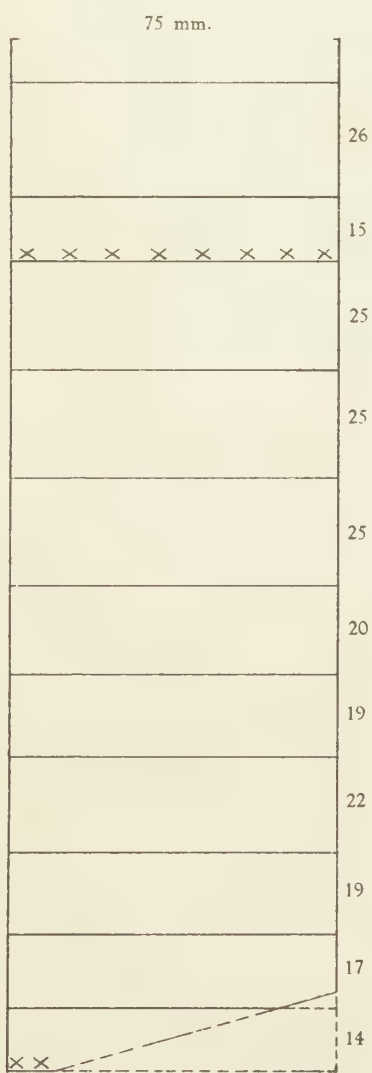
Text fig. 1.
Diagram of the specimen
shown on Pl. 1, fig. 1, 2.



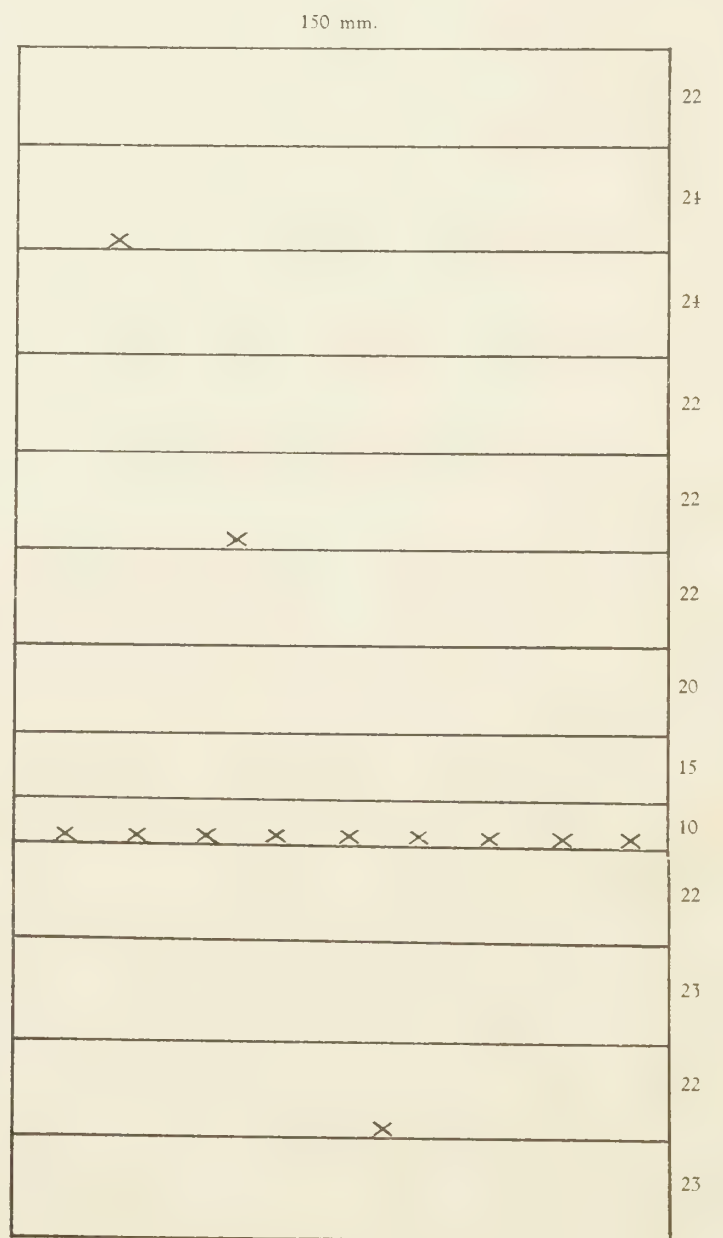
Text fig. 2.
Diagram of the specimen
shown on Pl. 21, fig. 1.



Text fig. 3.
Diagram of the specimen
shown on Pl. 28, fig. 2.



Text fig. 4.
Diagram of the specimen
shown on Pl. 30, fig. 1, 2.



Text fig. 5.
Diagram of the specimen
shown on Pl. 5.

Diagrams of aerial stems of CALAMITES UNDULATUS STERNB.

fig. 2 a few of the ribs end in the characteristic sharp points and the tubercles at the upper ends can also be seen. Lying upon the internode above that which bears the branch scars in fig. 1, 2, Pl. 9 as well as in fig. 2, Pl. 10 a curious circular wreath-like impression is seen. This is probably a displaced diaphragm (see also Pl. 151, fig. 2, 3).

Probable remains of the leaves are seen in fig. 2, Pl. 9 at the second node from the top at the left hand side of the figure.

Another specimen showing the outer surface of the bark and the pith cast is given on Pl. 15, fig. 2, 3. Here the outer surface, fig. 2, has been removed from the pith cast shown at fig. 3 on to which it fits. Fig. 2 shows the outer surface. Parts of four nodes are seen and on each of these with the exception of the uppermost one, a circular scar is present. These are possibly those of roots, as they seem to cause no convergence of ribs towards the node on the cast or only do so to a very slight extent. In addition to a transverse wrinkling and the usual fine ornamentation of the species, the surface shows a number of longitudinal, irregularly placed depressions of various form and size, which may have originated through rupture of the bark. Fig. 3 calls for no special remark otherwise than that it shows very clearly the distinctive markings of the pith cast of *Calamites undulatus*.

A somewhat similar condition, showing part of the pith cast attached to the impression of the cortex is shown in STUR, Calam. Schatzl. Schichten, Pl. 2b, fig. 1, but here the specimen is erroneously referred to *Calamites sachsei*.

The earliest figured example of *C. undulatus* showing the outer surface of its bark is that given by STEINHAEUER on his Pl. 4, fig. 1, under the name of *Phytolithus parmatus*, on which the leaf scars, branch scars, and longitudinally striated surface are distinctly shown.

The best figure of the outer surface of *Calamites undulatus* is that given on Pl. 8, fig. 1 where four complete and two incomplete internodes are shown. These vary in length. That bearing the branch scars is the shortest while that immediately below the branch bearing node is the longest on the preserved fragment of the stem. The leaf scars are particularly well shown and their details of structure can easily be seen if the figure be examined with a lens. The outer surface of the cortex shows the usual characteristic vertical striations.

Another specimen showing the outer surface is given on Pl. 34, fig. 4. Only one verticil of branch scars is seen towards the base of the fossil and above this branch bearing internode the others increase regularly in length. Two enlargements of the surface of the cortex are given on Pl. 35, fig. 1, 2. On this example the cortex was converted into a coaly substance and except exhibiting a few longitudinal cracks the surface was otherwise almost smooth. These enlargements also show the form of the leaf scars.

A small fragment of another stem is seen on Pl. 30, fig. 5. Here the branch scars are somewhat more circular than usually found in this species but otherwise the specimen conforms with the general character of the *Calamites undulatus*. The branch bearing

internode is succeeded by another very short internode. This again is followed by one of much greater length than those usually found in this position.

The specimen figured by ZEILLER as *Calamophyllites varians* (Brive, Pl. 11, fig. 1) is reproduced in its entirety on the left hand of our Pl. 11, fig. 1. It shows a portion of the outer surface of a cortex and though no organic connection can be traced with the cast of *Calamites undulatus* lying beside it, it very possibly belongs to it as the bark bears the characteristic leaf scars and surface ornamentation of that species.

III. *Pith casts.*

It is very seldom possible to separate the pith casts of the aerial stems from those of the rhizomes, though in a few cases they can be distinguished. It is best to begin with the description of those specimens which can be referred without doubt to the aerial regions of the plant.

A good impression of a stem cast is seen on Pl. 12, fig. 2. On one of the nodes towards the centre of the figure, the position of three branch scars is indicated by three small circular elevations about 2 cm. distant from each other. To these, four or five of the ribs of the neighbouring internodes converge. It will be observed on this impression that the ribs on the right side of the fossil are somewhat flexuous and broader than those on the left side, which are straight. Not only this example but many others show the worthlessness as a specific character of the presence of straight or flexuous ribs on different individuals. As a further example illustrating this point, fig. 3, Pl. 28 is given. This is the other side of the specimen shown on Pl. 29, fig. 1. Similar examples have been figured by SEWARD (*C. undulatus*, 1888, p. 289, Pl. 9).

Another portion of an impression of a stem with very flexuous ribs is seen on Pl. 14, fig. 2. Four branch scars, indicated by shallow conical elevations are present on the lowest complete node. On the same plate, at fig. 4 a very small fragment is given which shows the flexuous ribs with their clearly defined sharp pointed terminations. They also have the larger tubercles at the top of the ribs, the smaller tubercles at their base and the cross-hatching on their surface. Another stem showing very similar characters to those just described is given on Pl. 16, fig. 1. The ribs here are in some cases, as seen on the left hand side of the uppermost internode, almost straight, whereas on other parts of the specimen some of the ribs, while straight or almost straight in their lower and upper portions, assume in their middle part a high degree of zigzag sinuosity. Some of the ribs here also show a central furrow, a character only occasionally seen in the pith casts of this species. Probably *Calamites insignis* SAUVEUR, Belgique, Pl. 13 and *Calamites sulcatus* GUTBIER, Zwickau, p. 27, Pl. 2, fig. 8 are founded on fragments of a similar condition of *C. undulatus*. (See also JONGMANS, Anleitung, I, p. 197).

The fragment of a stem shown on Pl. 18, fig. 1 is probably from an aged individual, in which the ribs have attained an unusual width, and on which the surface ornamentation is distinctly seen.

As an example of very long internodes an impression is given on Pl. 19, fig. 3, where, though the internode is incomplete it is 19 cm. long.

A stem with very short internodes is given on Pl. 21, fig. 1 and at Text fig. 2. Towards the base of the figure the remains of a verticil of branch scars are seen. The internode above this is very short, succeeded by one of about twice its length. Then follows a slightly shorter internode, but above this point they gradually and slowly increase in length.

The original specimen figured by WEISS under the name *C. suckowi* var. *undulatus* is reproduced on our Pl. 23, fig. 2. It shows very well the rectangularly pointed terminations of the ribs with their terminal tubercles. It is peculiarly interesting on account of the remarkable markings which occur on the lowest internodes. To these the ribs converge in a similar manner to that which occurs in the case of branch scars. The position of these markings precludes the possibility of their being true branch scars and they have probably arisen through some external damage to the bark during the life of the plant. ¹⁾

Fig. 3 of the same plate shows another small fragment of a stem where several of the ribs do not alternate at the node. This in some cases appears to be brought about by a somewhat abortive convergence of the ribs towards each other, though they do not appear to be associated with the formation of a branch scar.

A small fragment given on Pl. 24, fig. 3 shows a verticil of branch scars on the lowest node, succeeded by a very short internode. Here the convergence of the ribs at regular intervals indicates the existence of a real branch whorl.

On Pl. 25, fig. 2, 3, 4 and Pl. 26 fig. 2 is refigured the original of *C. acuticostatus* WEISS. Towards the centre of the illustration given at fig. 3 the terminations of some of the ribs seem to be produced into exceptionally long points but on other parts of the specimen the terminations of the ribs differ little or not at all from those occurring in other specimens of *Calamites undulatus*. The character then on which this species exists does not seem to us to be of sufficient importance for its separation from *C. undulatus*. The surface of the ribs shows the characteristic cross-hatching of the latter species. Two enlargements of portions of the specimen are given on Pl. 25, fig. 4 and Pl. 26, fig. 2. These may be compared with the enlargement given on Pl. 6, fig. 4 and 5.

On Pl. 6, fig. 4 and 5 are given enlargements of the specimen seen on Pl. 6 fig. 3. The top node of this example shows the characteristic rectangular terminations of the ribs of *C. undulatus* while the ribs on the lower node end in much longer points. This difference is well seen in the two enlargements and the consideration of this specimen has convinced us that the *C. acuticostatus* of WEISS must be united with *C. undulatus*.

Another specimen showing ribs which at one end are sharp pointed and at the other end rectangular is illustrated on Pl. 6, fig. 1 and an enlargement of one of the nodes is given on the same Plate at fig. 2.

¹⁾ The specimen of *Calamites undulatus* figured by GOODE, Q. J. G. S., London, LXIX, p. 262, Text fig. 2, and which is supposed to show on the "external surface root scars below the node", may result from some similar cause. The position of these markings precludes the possibility of their being root scars.

These two specimens, but especially the first described (fig. 3), show the surface ornamentation very beautifully on the enlargements. A similar but somewhat finer ornamentation of the ribs is seen on Pl. 23, fig. 4.

A fragment of a large stem with internodes of almost equal length is given on Pl. 7, fig. 1. It has suffered somewhat from pressure but the sharp points of some of the ribs are observable here and there at the nodes. A small part is enlarged on Pl. 6, fig. 6 where the ornamentation of the ribs is distinctly seen.

A small piece of a stem is given on Pl. 7, fig. 2. This shows towards the centre of the figure a branch scar verticil but the chief interest of this specimen is associated with its ribbing. Many of the ribs are straight while others are flexuous and on the same internode the ribs on the one half are more than twice as wide as those on the other and in proportion to their increase in width they appear to become more flexuous. The ribs on the internode towards the upper end of the fossil become very broad and flexuous and as the specimen is followed downwards the ribs become narrower and lose their flexuosity.

A curiously preserved impression kindly lent us by DR. L. MOYSEY is given on Pl. 8, fig. 2. Here the impression is still covered by a thin layer of coal so that we have the ribbing associated with a verticil of branch scars showing practically their external form. The internode bearing the branch scars is remarkably short in comparison with the internodes which immediately follow it. The leaf scars are not visible on this specimen.

A plant which has been described by STUR under the name of *Calamites suckowi* is given on Pl. 28, fig. 2 and at Text fig. 3. This specimen with its verticil of branch scars placed on a short internode, followed by those of greater length, in its straight and flexuous ribs, terminating in sharp points, and in the ornamentation of their surface, is typical of *Calamites undulatus* under which species it is here placed.

Another pith cast and its impression are shown on Pl. 30, fig. 1, 2 and at Text fig. 4. Fig. 1 is the pith cast and shows one verticil of branch scars succeeded by a short internode, which is common in this species. On the impression (fig. 2) the branch bearing node is the highest seen on the figure and corresponds to the third node from the top of the cast (fig. 1). The prominence of the branch scars on the cast varies a good deal in different specimens and in this case the convergence of the ribs towards the umbilicus of the branch scars is somewhat feebly developed. The ribs towards the lower part of fig. 2 show very distinctly their rectangular ends and the tubercles at their upper ends.

The specimen given on Pl. 39, fig. 1 is a fragment of a pith cast showing a scar verticil succeeded by a short internode. The position of the branch scars is indicated by the convergence of the ribs on each side of the node towards the central point but in this case the scars seem to be very feebly developed. Some parts of the ribs here are very sinuous while other portions of the same ribs are almost straight.

Another portion of a pith cast is given on Pl. 47, fig. 7 and the other side of the same specimen is seen on Pl. 48, fig. 1. This example shows with great clearness, in addition to the ordinary characters possessed by this species, the larger tubercles at the

tops of the ribs and the smaller at their bases. When these smaller tubercles are present they generally occur with great distinctness though in the majority of cases they seem to be absent. An enlargement of part of this specimen showing the surface ornamentation is given on Pl. 50, fig. 5.

A fine pith cast is given on Pl. 5, fig. 1 and at Text fig. 5. It bears one verticil of branch scars at the base of a very short internode, followed by an internode of about twice its length. The succeeding internodes, of which there are seven, are of nearly equal length. Two of these, the second and fifth from the top, show each, at one part, a slight convergence of the ribs and it is possible that in addition to the verticil of branches, isolated branches may have been borne on these nodes. We have however never seen on specimens showing the outer surface of this species, the occurrence of isolated branch scars on the nodes though such occur on *Calamites goepperti*. The ribs in this specimen are wide and flexuous.

One of the most interesting specimens figured on these plates is the original of BRONGNIART's *Calamites decoratus* which is here given on Pl. 10, fig. 4 and a portion of it enlarged at fig. 5. This example which has very short internodes shows quite clearly some straight and some flexuous ribs with their rectangular terminations and the tubercle at their upper end. On a few of the ribs the tubercle at the lower end can also be observed. The characteristic surface ornamentation of the *Calamites undulatus* is seen on the enlargement fig. 5. Reference to this specimen has already been made when discussing the name to be adopted for this species. ¹⁾

A specimen figured by STUR as *Calamites schützei* can only be regarded as a somewhat imperfectly preserved specimen of *Calamites undulatus*. It is refigured here on Pl. 13, fig. 2. The whole of the characters observable on the specimen: — the sharp pointed ribs with the small circular tubercle at their upper ends, their surface ornamentation as well as a slight tendency to become flexuous, undoubtedly refer this specimen to *C. undulatus*.

A young stem or branch is given on Pl. 14, fig. 3 chiefly to show the length attained by the internode, which however is incomplete. On the original the surface ornamentation is beautifully preserved.

A stem showing internodes of almost equal length, except those immediately associated with the node bearing the branch scars is given on Pl. 16, fig. 2 and at Text fig. 6.

The branch bearing internode is here distinctly longer than the one immediately above it, a condition rarely seen in this species. The branch scars on this specimen are very clearly indicated. At the second node from the top and the second node from the bottom the ribs end in long sharp points and in this respect approach closely to those of the specimen named *C. acuticostatus* by WEISS (Pl. 25, fig. 2—4; Pl. 26, fig. 2).

A basal portion of a stem, of which we have met with remarkably few examples, is given on Pl. 26, fig. 4. As is usual in the terminations of *Calamites* stems, the internodes

¹⁾ See ante p. 9.

become very short, and from the pressure of one internode upon the other the terminations of the ribs are generally flattened. In a few places here however one can still observe their rectangular terminations and the tubercles on their upper ends.

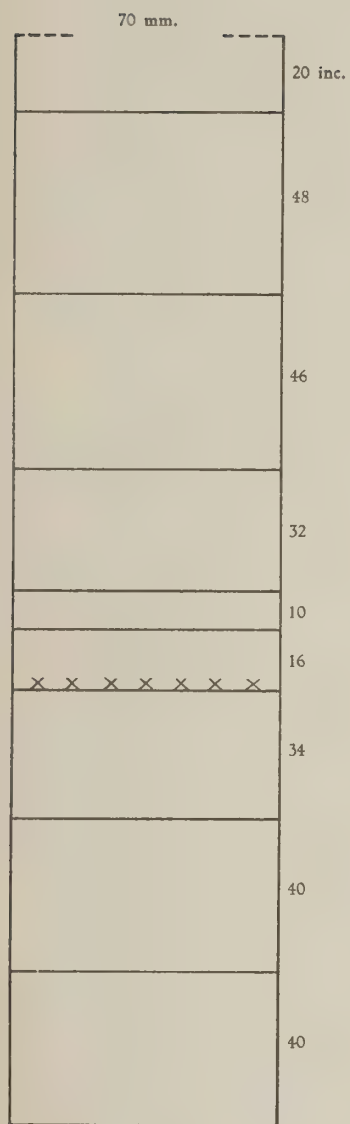
Another termination of a stem is shown on Pl. 31, fig. 2. In this the internodes are much longer than on the specimen just described. Possibly the end of the stem is wanting on this example. In the second internode from the top the ribs converge towards a small scar which is seen enlarged at fig. 1. It is highly probable that this scar indicates the position of a lateral root. The surface marking of the ribs, their flexuous course and the sharp ends of some of them clearly refer this termination to *C. undulatus*. In the GOLDENBERG Collection in the Palaeobotanical Department of the Museum of the Royal Academy of Sciences, Stockholm, is preserved the specimen shown on Pl. 29, fig. 2 which is named in GOLDENBERG's writing "*Calamites sinuatus*". This however is merely an example of *Calamites undulatus* similar to some already described. We give a figure of it here as GOLDENBERG seems to have regarded it as a distinct species and there is a possibility of the name being discovered on specimens in other collections.

A form with very broad ribs and comparatively short internodes is seen on Pl. 30, fig. 3. At two places the ribs converge at the nodes but whether these only indicate the occurrence of isolated branch scars or form members of true verticils of scars, the specimen is too incomplete to determine.

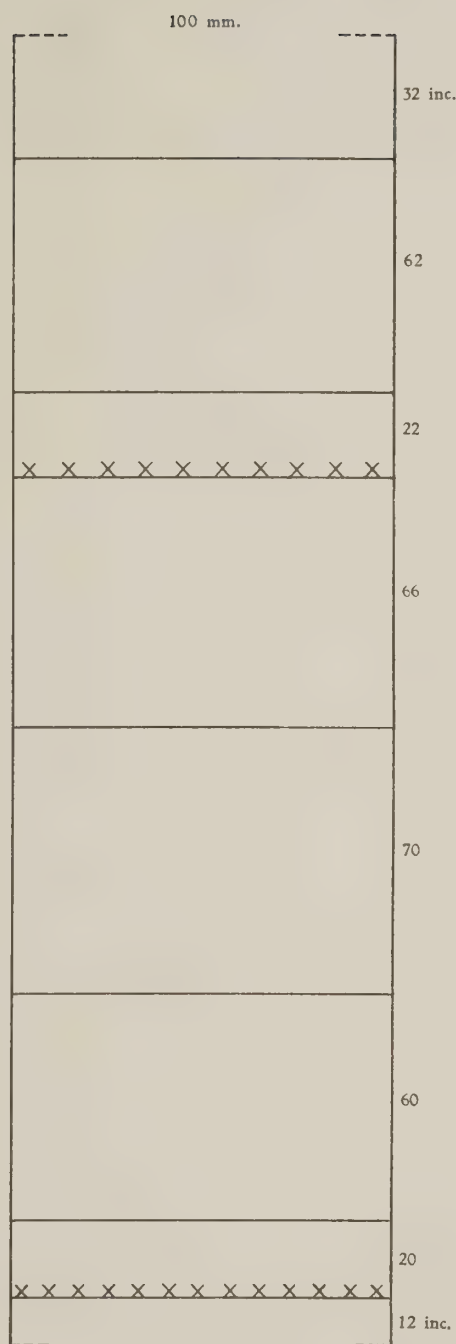
Part of the original of BRONGNIART's *Calamites suckowi* (Histoire, Pl. 15, fig. 1) is reproduced on our Pl. 32, fig. 1 and at Text fig. 7. The node at the base immediately above the crack in the specimen shows a verticil of branch scars though very imperfectly preserved. On the lower part of the specimen (not shown in our plate) and separated from the upper node which bears branch scars by four internodes, is another whorl of branch scars. Some of the ribs, especially in the lower part of the specimen (not shown in our figure) are flexuous and these as well as some on the portion reproduced by us have a rectangular termination and the surface markings of *Calamites undulatus*. The two short internodes bearing branch scars are shown in the figure given by BRONGNIART but the scars are omitted. He further shows on the specimen he gives natural size, as well as on the enlargements, fig. 2 and 4, the rectangular terminations of the ribs.

Part of a specimen, 54 cm. long, is given on Pl. 33, fig. 1, 2 and at Text fig. 8. The lowest node of fig. 1 is the same node as seen at the extreme top of fig. 2. This example shows two verticils of branch scars separated by 12 internodes without any scars. Above the upper verticil at least 11 internodes without scars are present. The internodes immediately above the branch bearing internode are very short but from this point upwards they gradually increase in length, the longest one being immediately beneath the whorl of scars. The specimen is preserved as a sandstone cast and though it shows very clearly in many parts the rectangularly pointed terminations of the ribs, the tubercles are only seen at a few places and the surface ornamentation has entirely disappeared.

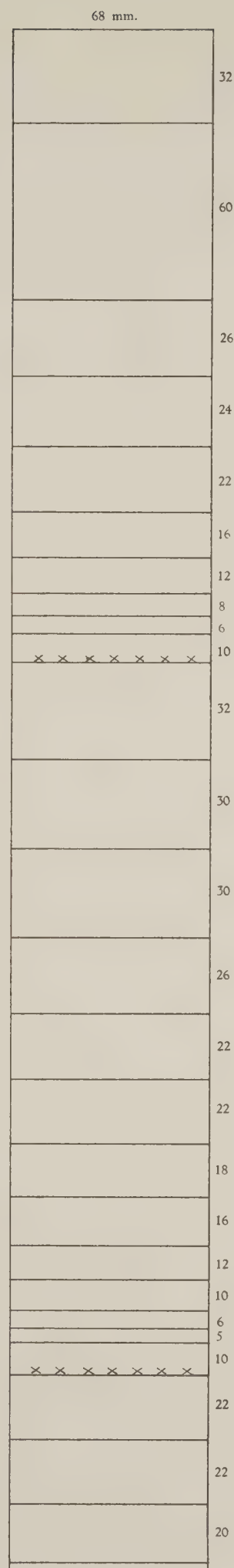
A very similar specimen is figured by BRONGNIART on his Pl. 24, fig. 1, under the name of *C. approximatus* and it is given on our Pl. 34, fig. 1, 2, 3 and at Text fig. 9.



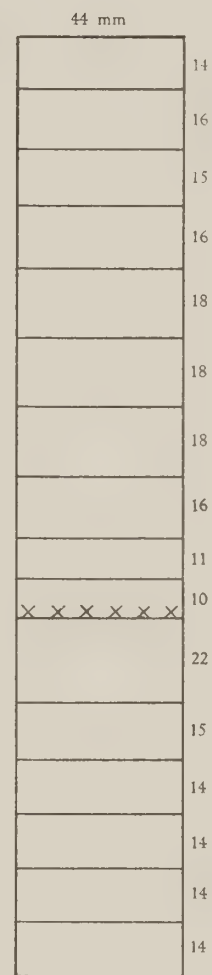
Text fig. 6.
Diagram of the specimen
shown on Pl. 16, fig. 2.



Text fig. 7.
Diagram of the specimen
shown on Pl. 32, fig. 1.



Text fig. 8.
Diagram of the specimen
shown on Pl. 33, fig. 1, 2.



Text fig. 9.
Diagram of the specimen
shown on Pl. 34, fig. 1, 2, 3.

Diagrams of aerial stems of
CALAMITES UNDULATUS STERNB.

The fossil, of which both sides are represented by us shows a branch whorl, immediately above which there are the usual short internodes. In fig. 1, which is the view represented by BRONGNIART, on the internode immediately below the branch whorl, (which is not shown in his Plate), a fracture or an abrasion of the surface gives the false appearance of a node. This is represented as such on BRONGNIART's figure. An examination of the other side of the fossil however shows that there is no node at this point and that the appearance of one on the other surface is purely accidental. In fact there is in this specimen the usual long node below the branch bearing internode which in turn is succeeded by the customary shorter internode. This specimen being a sandstone cast is not very well preserved and does not show minute detail of structure but on the enlargement given at fig. 3 one can still observe the indication of the tubercles and the pointed terminations of some of the ribs.

A typical form of stem is shown on Pl. 3, fig. 1, which has a whorl of branch scars at the second node from the base. Immediately above this as almost invariably is the case, occurs a short internode. This is succeeded by internodes of gradually increasing length.

Immediately below the branch scar the longest internode is found. In addition to the branch scars which form a verticil, on two of the nodes above it, a convergence of the ribs is seen but these ribs do not meet in a central point and if they bore any appendicular organ it must have been of smaller dimensions than those borne on the true branch scars. The specimen further shows the rectangular points of the ribs and the surface cross-hatching.

Under the name of *Calamites schatzlarensis*, STUR includes stems of probably three species. His figures Pl. 1, fig. 1, 2 represent large stems with wide ribs and show similar characters to those on our Pl. 7, fig. 1; Pl. 19, fig. 1, 2; Pl. 32, fig. 2 and Pl. 51, fig. 1. All these specimens and those figured by STUR (l. c.) only represent older and larger stems of *Calamites undulatus*. On the example given on Pl. 32, fig. 2, especially on the right hand side of the uppermost node, the sharp terminations of the ribs and their terminal tubercles are visible. The cross-hatching on the surface which can be observed on the specimen, is not so clearly seen in the figure.

A large and old stem of the "*schatzlarensis*" form is given on Pl. 51, fig. 1. This is very typical of the plant described by STUR as *C. schatzlarensis* and at the node shown at the lower part of the specimen, the very sharply pointed ribs are clearly seen. It seems to be the case on these old and large stems that the ribs end in longer points than on the smaller and younger examples. We have here in this specimen a condition of rib termination which might be compared with those of *C. acuticostatus* of WEISS. The example given on Pl. 19, fig. 1, 2, illustrates very much the same conditions but here a more prominent triangular form of the ribs is seen, which, from some cause seem to have frequently been fractured along the course of their ridges. This specimen is one of those intermediate conditions and probably represents that portion of the aerial stem which held a subterranean position as it shows root scars at the nodes. Such portions of the stem can usually be distinguished from true aerial parts by the presence of scars on all

the nodes. These scars are circular, of comparatively small size and with a much less prominent or even entire absence of convergence of the ribs towards them. They consist almost entirely of a central circular umbilicus or sometimes a simple plain cup-like depression. At fig. 2 which is a photograph of a part of the other side of the same specimen, these root scars and the arching of the ribs are very well seen.

Among the specimens which may be referred to the "*schatzlaensis*" condition is that shown on our Pl. 24, fig. 1, which differs only from those described in its possessing flexuous ribs. At fig. 2, a small portion of the impression of the other side is given where two root scars are visible but towards one of them the ribs show an unusual amount of convergence. Still we see in the centre of the scar the cup-like depression characteristic of root scars.

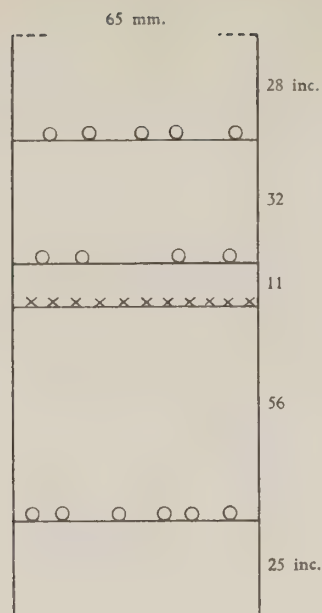
To return to fig. 1 of the same plate, towards the centre of the uppermost internode, at several points there is an apparent coalescence of certain of the ribs but if this part be carefully examined this appearance seems to be produced by an overlapping of the ribs one upon the other and in one case, a narrow band can be traced connecting the two wider portions of the rib. A similar condition is figured by WEISS. (Steink. Calamarien, II, p. 135, Text figures).

A very large rhizomatic portion is given on Pl. 37 and at Text fig. 10. Here root scars occur on each of the nodes and on the left hand of the internode towards the centre of the figure one can distinctly see, especially if examined with a lens, the sharp terminations of the ribs with the larger oval tubercle at their upper ends and the small punctiform tubercle at their lower ends. An enlargement of portion of this specimen is given on Pl. 36, fig. 5, that shows the surface ornamentation, which, on the rhizomatic parts of the stem is always limited to a band running up the central part of the rib.

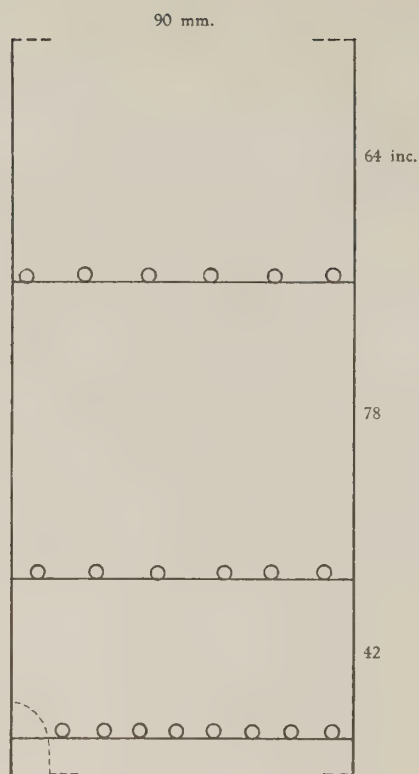
A portion of the counterpart of this specimen is given on Pl. 36, fig. 3 and a small piece of it enlarged at fig. 4. On the uppermost node three root scars are shown whilst on the central node the impressions of six are visible. They are irregularly distanced from one another. The enlargement given at fig. 4 shows the large tubercles and the ornamentation of the outer surface of the ribs.

When one is dealing with rhizomatic portions of Calamite stems, examples are occasionally found which, in addition to showing root scars also show verticils of scars indistinguishable from those of branch scars. An excellent pith cast of such a specimen is given on Pl. 3, fig. 3, and at Text fig. 11. Here four nodes are preserved, the uppermost of which bears 5 root scars, the next four, and this is succeeded by a very short internode bearing 8 or 9 branch scars. Then follows the ordinary long internode which usually underlies the branch bearing internode. On the node at the base of this internode, 5 root scars are seen.

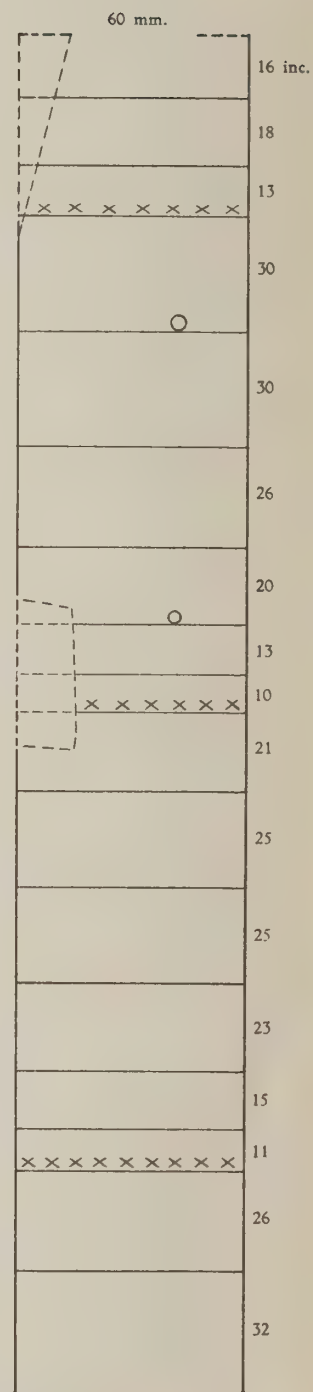
These five root scars with their circular boss-like form, their variation in size and irregularity of position and the absence of the convergence of the ribs towards them, strongly contrast with the almost universal regularity in the position of the branch scars to each other and their associated convergence of the ribs.



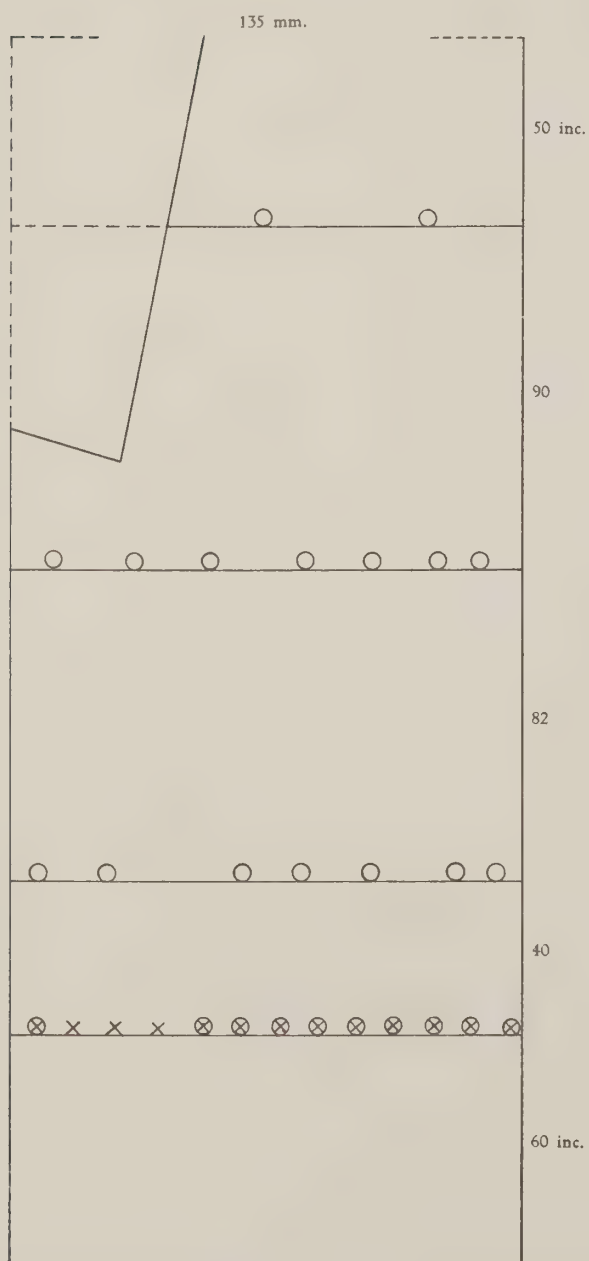
Text fig. 11.
Diagram of the specimen
shown on Pl. 3, fig. 3.



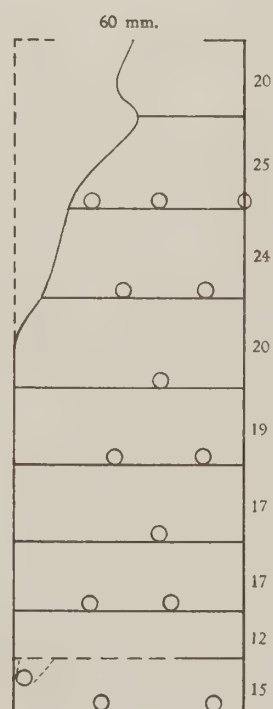
Text fig. 12.
Diagram of the specimen
shown on Pl. 23, fig. 1.



Text fig. 13.
Diagram of the specimen
shown on Pl. 35, fig. 3, 4.



Text fig. 10.
Diagram of the specimen
shown on Pl. 36, fig. 5 and Pl. 37.



Text fig. 14.
Diagram of the specimen
shown on Pl. 26, fig. 3.

Diagrams of rhizomes of *CALAMITES UNDULATUS* STERNB.

× Scars towards which ribs converge.
○ Root scars.

It should be further pointed out that a verticil of branch scars is always associated with a short internode whereas the presence or absence of root scars seldom seems to influence the length of the internode on which they are placed. It does however rarely happen that the verticil of root scars may occur at the base of a short internode, as seen in fig. 2 of Pl. 3, but in such cases the verticil is always a regular one and the ribs converge more or less towards them.

On three of the other nodes seen in this specimen typical root scars occur.

That roots were borne at the verticil seen on this specimen, the form of the scars makes quite clear. On the other hand their occurring on a very short internode leads one to infer that there has been here a modification of a structure which under normal conditions one would have expected to have developed as branches.

A similar example is shown on Pl. 157, fig. 5, but here the specimen exhibits the outer surface of the stem. The fossil shows portions of three internodes but only the central one gives its complete length and is evidently shorter than those occurring immediately above and below it. The upper node bears four root scars and perhaps the fragment of a fifth one at the right margin. They are irregularly spaced and do not show a clear scar but appear as if the roots had been forcibly removed from them. Probably the roots were attached when the specimen was imbedded in the rock and extending into the matrix that surrounded the stem, they were broken off when the nodule containing the fossil was split open. Between the root scars some of the characteristic leaf scars are clearly observable.

On the lower node four perfect and two imperfect typical branch scars are seen. From these the branches have apparently been shed while the plant was in life as they show the central cicatrice to which the branches were originally attached quite distinctly.

Another specimen shown on Pl. 13, fig. 1, further illustrates this point. On the fifth node from the bottom a verticil of root scars is seen at the base of a short internode, but in this specimen the whole appearance of the fossil leads one to believe that the upper portion was aerial while the lower part had assumed rhizomatic characters. Here again there is a verticil which from the regularity of the scars at the base of a short internode, one might naturally have expected to produce branches whereas undoubtedly it bore roots as shown by the form of the scars and the non-convergence of the ribs.

A very interesting fossil showing verticils of root scars on three nodes is given on Pl. 23, fig. 1 and at Text fig. 12. Here however those on the lowest internode have a convergence of the ribs towards them, and are more numerous and more regular, than those seen on the other two nodes where they are more distant and more irregularly placed with very little convergence of the ribs towards them. The lowest internode bearing this verticil of regularly and closely placed scars is shorter than the two internodes above it, for the uppermost one though incomplete on the specimen is 6,5 cm. long but only a portion of it is shown in the figure. It should be here mentioned that the rhizomatic and aerial portions differ in that on the former, verticils of root scars may

arise from every node whereas in the aerial, the branch scars are only borne periodically.

In connection with this subject we might refer here to the specimen on Pl. 20 where there is to a certain extent, a combination of the characters of root scars and branch scars. For though the scars here are distinctly those of the root type the ribs converge towards them and as already mentioned, this is characteristic of branch scars. The ribbing on parts of this specimen is more flexuous than usually found on rhizomatic portions. On the left hand lower corner a number of roots are seen on the matrix which occur as flattened ribbon-like bands bearing numerous transverse wrinklins.

On Pl. 35, fig. 3, 4 and at Text fig. 13 are shown parts of one specimen, which as seen in the diagram of this fossil bears two verticils of scars. One of these is seen at the base of a short internode towards the top of fig. 3, the other comes in between the base of fig. 3 and the top of fig. 4, while a third verticil, imperfectly preserved, is seen at the third node from the lower margin of fig. 4. All these nodes which bear scars are at the base of the shortest internodes on the specimen. In this case the scars are not clearly seen and it is possible that they are the remains of three verticils of abortive branches. In addition to these a characteristic root scar is observable on the fourth node from the top of fig. 3. On the right margin of fig. 4 two roots are still seen attached. These are united to the pith cast by a widely expanded base which forms a decurrent marginal band down the side of the cast.

Two enlargements of this specimen are given on Pl. 36, fig. 1, 2. Fig. 1 shows the sharp pointed terminations of the ribs and fig. 2 the surface ornamentation and some of the root scars on the lowest node.

At fig. 3, Pl. 26 and Text fig. 14 is given a specimen in the collection of Mr. JOHN SMITH, DALRY, which shows the root scars occurring on all the nodes as well as one of the roots still attached. This example might have been described as a *Eucalamites* of WEISS of the *C. cruciatus* group. It shows the flexuous ribs so common in *C. undulatus*. The attached root has the usual basal expansion which extends along the margin of the specimen.

Another example showing the roots attached is that given on Pl. 11, fig. 1. This specimen as well as that given on Pl. 12, fig. 1 have been described as *C. leioderma* by ZEILLER. Both are rhizomatic portions of *C. undulatus*, an opinion in which ZEILLER now agrees. That given on Pl. 11, fig. 1 still shows three roots attached on the right side. Here as in all the other cases where roots are shown attached, the pith cast is bordered by a decurrent band.

A small portion of fig. 1 is enlarged at fig. 2 and exhibits the ornamentation of the ribs.

The specimen given on Pl. 12, fig. 1 shows three root scars placed at the base of a short internode. These are most typical in their form, arrangement, structure and the non convergence of the ribs towards the scars. On the two nodes immediately above this one, are seen in one case two scars and in the other case one smaller, but quite typical root scar. Also on the second node below this prominent verticil of root scars a single one

occurs. These latter described specimens have a fine ribbing and an almost entire absence of flexuosity of the ribs. These two characters are usually found associated on the rhizomatic portion of *C. undulatus*

On Pl. 26, fig. 1 and Pl. 25, fig. 1 and at Text fig. 15, 16 are illustrated the two sides of a pith cast as represented by its impression on the matrix. This specimen illustrates some curious characters regarding the distribution of the root scars. The second node from the top on Pl. 25, fig. 1 corresponds with the top node of Pl. 26, fig. 1. On this node there has been an incomplete verticil of root scars for on part of the node, as seen on Pl. 26, fig. 1, they are absent.

Here then one side of the second internode bore five most typical root scars, while the other side of the same node, as far as preserved, does not show a single scar. It exhibits however very beautifully the rectangular terminations of the flexuous ribs and their terminal tubercles. The third node on Pl. 26, fig. 1 shows three scars and a fourth is hidden in the shadow at the margin, on the other side of the same node (Pl. 25, fig. 1) three scars are seen. On the fourth node from the top on Pl. 26, fig. 1, five scars are visible, on the same node on the other side three or perhaps four are seen. On the fifth node of Pl. 26, fig. 1, none are shown, and on the opposite side two.

This specimen exhibits in the ribbing the characters of an aerial stem and in the root scars those of a rhizome and probably represents that portion of the plant in which the aerial stem is assuming the form of a rhizome.

The fossil given on Pl. 38, fig. 1 is very typical but is a composite figure as the right half portion belongs to one rhizome and the left hand portion to another as shown by the orientation of the tubercles on the ribs. On the fragment lying to the right of the figure, two most typical root scars are preserved, one on each node. An irregular placing of the root scars is very typical of their distribution on the rhizomatic portions of the plant.

The example given on Pl. 18, fig. 2 shows a fragment of a rhizome with a verticil of root scars on the lowest node. The structure of these is typically root like both in their form and their irregular distribution on the node as well as in the entire absence of rib convergences towards them. The internode immediately above them is very short and does not appear to have borne roots, this is succeeded by a long internode. The node at the top of this long internode bears two scars very distantly placed and scarcely so large as the other scars on this specimen.

Another interesting example is given at fig. 1, Pl. 14 and Text fig. 17 which shows portions of nine nodes. The first from the bottom bears a verticil of scars of the branch bearing type. This is surmounted by a very short internode and above it seven others of almost the same length as the lowest one. The second, fifth, and seventh nodes from the base bear each a single root scar, those on the second and fifth node being especially clearly shown. The difference between the structure of the branch scars and the root scars is well seen on this specimen.

Another specimen, the two sides of which are seen on Pl. 21, fig. 2, and Pl. 22, fig. 1, shows particularly large root scars on all the nodes. The uppermost node, on the

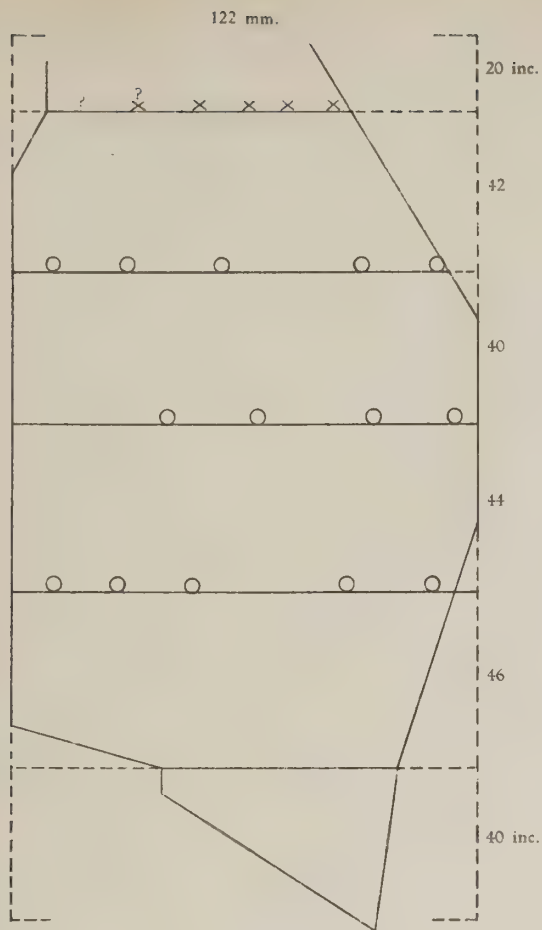
full circumference of the rhizome as far as it is preserved, shows two large root scars, measuring rather more than one cm. in their longest diameter as seen on Pl. 21, fig. 2. On the middle node, Pl. 22, fig. 1 and Pl. 21, fig. 2, are three large root scars and on the lowest node two are present. In addition to these large scars there are slight indications on all the nodes of smaller and imperfect scars, which probably were abortive and never bore any roots. This is more clearly seen at the lower node of fig. 2, Pl. 22. On the large upper scar on this figure the ribs are seen to converge towards its centre where they meet in an eccentric point.

The internodes are very long and unaffected by the presence of the large scars. Notwithstanding the large size of the rhizome the ribs are of the narrow straight type characteristic of rhizomes.

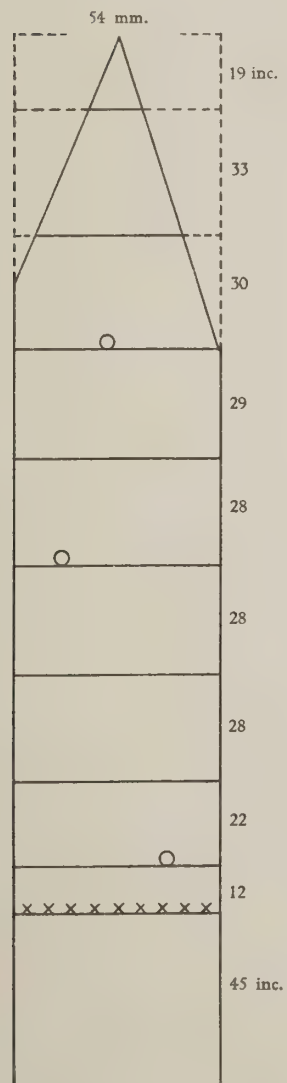
The two sides of a similar type of rhizome are given on Pl. 17, fig. 1 and 2. Here the only node shown with any completeness bears two large scars and indications of three abortive ones. The ribs end in sharp points with large tubercles, the former being especially well seen at the base of fig. 1. The ribbing is of the narrow rhizomatic form.

The figured part of this specimen is in the collection of the Chemnitz Museum and another portion of the same example which fits on to one end, is preserved in the Osnabrück Museum. It shows two other internodes of the same length. The nodes do not bear any root scars. The ornamentation on the surface of the ribs is clearly visible on this part of the specimen.

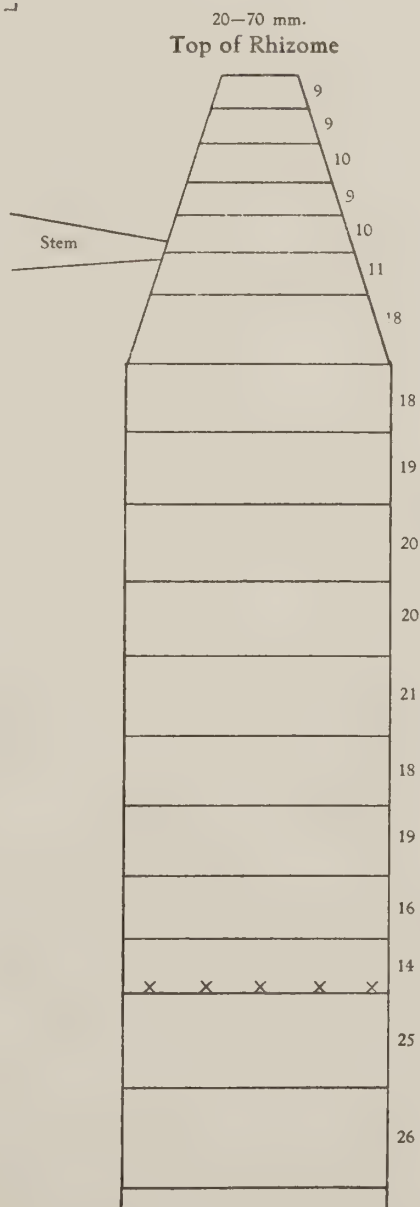
The most interesting specimen of this species which it is our good fortune to describe is the original of *Calamites varians* figured by STERNBERG in 1833 on Pl. 12 and since refigured by WEISS under the name of *C. varians inconstans*. The specimen is preserved in the Bohemian Museum at Prague. STERNBERG's figure is slightly enlarged but it is shown natural size on our Pl. 4, fig. 1, 2 and a diagram is given in Text fig. 18. The lower portion of fig. 1 duplicates the upper part of fig. 2. One can easily see by comparing their outlines the exact spot where the line of union takes place. In STERNBERG's original figure only a part of the specimen is given for he entirely omits to include the stem which is seen at the base of our fig. 2 at the right hand side. Although at the first sight not very clear on the figure it can easily be seen that this lateral stem is connected to the rhizome by an expanded plate of carbonized cortex. A similar growth takes place in all examples where stems are given off from rhizomes or other stems. The stem proper terminates in this mass of carbonized tissue in a blunt conical point which can faintly be seen in the figure. The parent rhizome itself, as evidenced by the shortening internodes towards the apex, is also seen to be nearing its termination, its growing point being directed towards the base of the plate. That this is a true free growing rhizome, as distinct from a branch of a stem is seen from the position of the tubercles which are at that end of the ribs which point to the growing apex. If the specimen had been a stem springing from another stem than the tubercles would have been at the opposite end of the ribs. And further that this is so is shown by the position of the scars in the verticil seen towards the top of fig. 1, which in the position they occupy



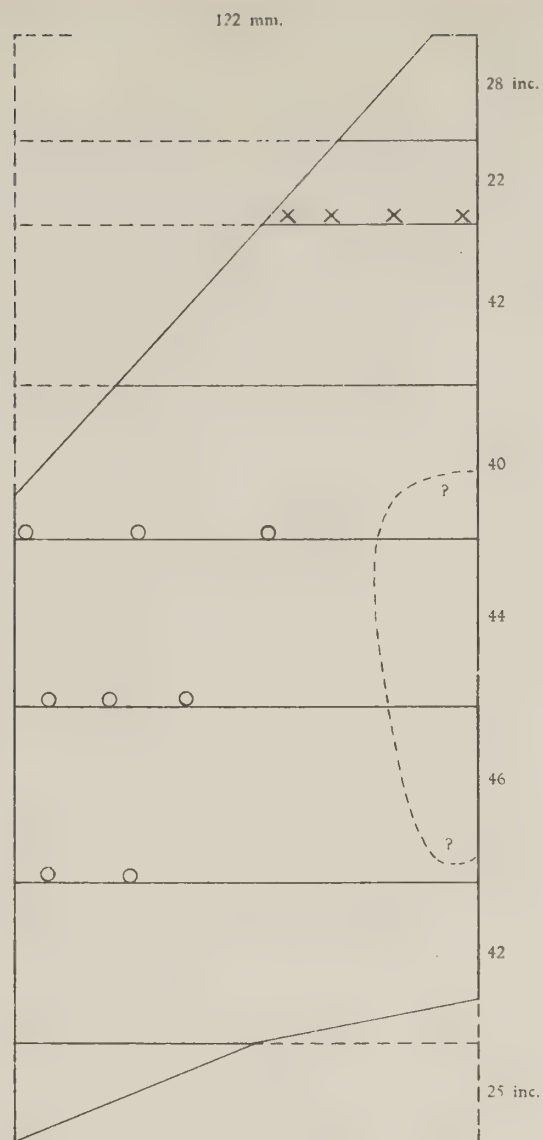
Text fig. 15.
Diagram of the specimen
shown on Pl. 26, fig. 1.



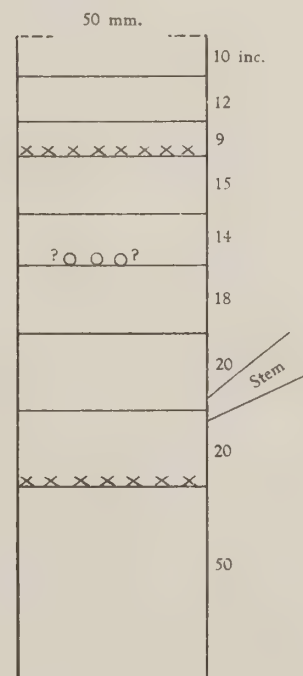
Text fig. 17.
Diagram of the specimen
shown on Pl. 14, fig. 1.



Text fig. 18.
Diagram of the specimen
shown on Pl. 4, fig. 1, 2.



Text fig. 16.
Diagram of the specimen
shown on Pl. 25, fig. 1.



Text fig. 19.
Diagram of the specimen
shown on Pl. 10, fig. 3.

Diagrams of rhizomes of *CALAMITES UNDULATUS* STERNB.

× Scars towards which ribs converge.
○ Root scars.

appear as arising from immediately below the node whereas in reality they arise from immediately above it in the usual manner.

The stem arising from this rhizome is not so perfectly preserved as the rhizome itself but still it shows on the original the sharp terminations of the ribs and the presence of the terminal tubercle and on the rhizome itself can be seen at certain places the characteristic ornamentation of the outer surface of *Calamites undulatus*.

This specimen therefore which has previously been regarded as the type of a species, *Calamites varians* STERNBERG, is here shown to be the rhizome of *C. undulatus* giving birth to a lateral stem.

Another stem springing from a rhizome is given on Pl. 10, fig. 3 and at Text fig. 19. The rhizome shows portions of seven nodes. On the lowest, third and sixth from the base small root scars are borne and from the second node from the base a stem arises connected with it by an expanding cushion. The stem itself is here very well preserved and shows three internodes. On the rhizome the characteristic rhizomatic ornamentation of *Calamites undulatus* can be observed on some of the ribs.

Another interesting specimen showing a stem arising from its rhizome is given at fig. 1, Pl. 27. It has been figured by FEISTMANTEL (1874) under the name of *C. cannaeformis*. Each of the two upper nodes bears a single typical root scar and from the lowest node springs a stem, the cast of which is still embedded in the rock and it only shows its base on a level with the impression of the rhizome. The ribs on the rhizome are slightly flexuous and the stem shows most distinctly the sharp pointed terminations of its ribs.

A fourth specimen showing the attachment of a branch is given on Pl. 32, fig. 3, 4 and on Pl. 9, fig. 4. Pl. 32, fig. 4, shows the cast of the termination of the stem and on the rock beside it are the remains of the bark now represented by a carbonaceous film. Fig. 4, Pl. 9 shows the specimen when the portion fig. 3, Pl. 32 has been placed upon that of fig. 4 of the same plate, so that the impression of the stem shown at the upper left hand side of fig. 3 fits on to the termination of the branch shown at fig. 4 or in other words the ribbed portion seen at fig. 4, Pl. 9 is the other surface of the piece seen at fig. 3, Pl. 32. On Pl. 9, fig. 4 the small fragment of a stem seen coming out obliquely at the right margin of the figure is the upper part of the stem seen at the left hand corner of fig. 4, Pl. 32.

Pl. 31, fig. 5 shows a stem arising from another stem. Here we are looking at the compressed termination of the new stem which has arisen from the stem of which our fossil shows the impression. The impression of the parent stem shows the characteristic flexuous ribs with the cross-hatching extending over the whole of their surface. A similar specimen, but with smaller scar, is given on Pl. 137, fig. 3.

A basal portion of a cast of a parent stem showing the scar from which a stem has been given off is seen on Pl. 44, fig. 1. The parent stem is normal in every respect and shows the flexuous ribs ending in sharp points with terminal tubercles. The second internode from the base of the figure shows also a verticil of root scars.

A large stem scar is seen on the small specimen given on Pl. 30, fig. 4. It occupies

the whole width of the internode and its upper and lower margins are somewhat flattened against the nodal lines. Radiating lines extend from the margin to the central umbilicus. The leaf scars though not very distinctly preserved show upon their connecting band the typical striations of *Calamites undulatus*.

Another specimen showing these stem scars is given on Pl. 15, fig. 1. Here two very clear impressions of the bases of daughter stems occur on the fourth and eighth nodes from the base. Carbonaceous cushions, the remains of the tissue in which the daughter branches were embedded at their union with the stem are very distinctly seen surrounding both the scars. On the fifth node from the base a whorl of small scars is seen. In these last described specimens bearing large scars we are probably dealing with the basal portion of stems and not with true rhizomes.

On Pl. 9, fig. 5 is given a specimen of the *Cyclocladia major* L. and H. Fragments of two nodes are represented, one at the upper margin of the figure and the other one immediately underneath the three circular scars. It shows the outer surface of the bark which at the left margin thins away and is partially removed, revealing underneath the continuation of the nodal line which immediately underlies the large scars. These ribs show the characteristic ribbing of *Calamites undulatus* with their flexuous undulations and rectangular terminations. The scars are almost circular, irregularly placed and 1,5 cm. in greatest diameter. The umbilicus is almost central and bears a few radiating lines in its cup-like cavity.

For comparison with this specimen we reproduce on Pl. 33, fig. 4, LINDLEY and HUTTON's type of *Cyclocladia major*. This is a small fragment which shows part of a node bearing four large scars, — only the two central ones of which are perfect. Part of an internode lies above and below the scars. These scars are circular about 1,40 cm. in diameter, distant, unequally spaced, the intervals between them varying from 0,80 to 0,50 cm. Immediately within the circumference of the scars is a slight circular depression and again near the centre and surrounding an irregular boss which probably represents the point of attachment of the root, is another depressed circle. The surface of the cortex is smooth, with exception of some very fine and irregular longitudinal striae.

The nature of this curious fossil to which LINDLEY and HUTTON gave the name of *Cyclocladia major* is explained by the specimens given on Pl. 27, fig. 2, 3 and Pl. 28, fig. 1. On Pl. 27, fig. 2, 3 are illustrated the two sides of a termination of a stem which shows similar markings to those described on the specimen on Pl. 9, fig. 5. That these are the scars of large roots cannot be doubted as we are here dealing with the subterranean portion of the stem and not its apex as shown by the position of the tubercles at the upper extremities of the ribs. This specimen shows the occurrence of these large root scars on the three lower nodes as well as one at the extreme base of the fossil (fig. 3). On the other side of the specimen shown at fig. 2 the root scars do not appear to have been so numerous and are badly preserved. This example exhibits the characteristic *Calamites undulatus* ornamentation on some portions of its ribs and a small portion of another example is enlarged in fig. 4 where the cross-hatching is distinctly seen.

On Pl. 28, fig. 1 a fragment of a similar stem base is given where *Cyclocladia* scars are exceedingly well shown and must have borne when in life, roots of considerable size.

The three specimens last described are originals of specimens identified by RENAULT as *Calamites gigas*.

A small fragment of the outer surface of the bark is given on Pl. 31, fig. 4 which shows a strong and somewhat closely placed wrinkling. It is not without doubt that we refer this specimen to *Calamites undulatus* as the only evidence we have for doing so is the small fragment of a pith cast seen at fig. 3 of the same plate, which came from the back of the specimen showing the cortex but its association with the cortex may have been accidental.

IV. REMARKS ON SPECIMENS INCLUDED IN SYNONYMY.

The original of *C. undulatus* STERNBERG, II, Fasc. 5, 6, p. 47, Pl. 20, fig. 8 which is preserved in the Bohemian Museum, Prague, has been carefully examined and as far as its preservation admits an opinion to be formed has been correctly referred to this species. The locality however given by STERNBERG, Whitby, in Yorkshire, as that from which the specimen was derived is evidently erroneous. The plant if from Yorkshire, must have come from the neighbouring Yorkshire coalfield.

Of the three specimens figured by BRONGNIART as *Calamites nodosus* fig. 2 and 4 appear to be indeterminable, but his fig. 3 we refer to *Calamites undulatus*. The original specimen has been examined and his figure is a rather inaccurate representation of it. Although imperfectly preserved the specimen possesses sufficient evidence for its satisfactory reference to *Calamites undulatus* of which it is probably a rhizome.

We unite with *Calamites undulatus* the specimen figured under the name of *C. suckowi* by BRONGNIART (Histoire, I, Pl. 15, fig. 1), and provisionally also the enlargements given on the same plate fig. 2—5, which may have been taken from his fig. 1. Part of the original specimen is shown on our Pl. 32, fig. 1, to which reference has already been made.

Under *Calamites undulatus* must be placed the specimen figured by GEINITZ in his Steinkohlenflora von Sachsen under the name of *Calamites suckowi* (Pl. 13, fig. 4). The original, which is preserved in the Zwinger Museum, Dresden, shows quite distinctly the characters of *C. undulatus*.

STUR, in his "Calam. schatzl. Schichten", figures on his Pl. 1, fig. 3 and Pl. 14, fig. 1 two specimens which he refers to *Calamites suckowi*. Neither of these belong to that species. That given on his Pl. 1, fig. 3 is most probably referable to *C. undulatus* though its state of preservation scarcely admits of a satisfactory determination. (Original in the Geol. Reichsanstalt, Vienna). That however given by him on his Pl. 14 fig. 1 and which is reproduced on our Pl. 28, fig. 2, must be referred to *Calamites undulatus* as noted in the synonymy.

Among the specimens referred to *C. suckowi* by STERZEL (1907) that given on

his Pl. 57, fig. 2a, which is in the Geological Museum at Freiburg in Breisgau, must be referred to *Calamites undulatus*. The sharp pointed ribs of this species are well seen on his figure at "a".

The fig. 2 and 3 of BRONGNIART'S Pl. 21 which have been referred by him to *Calamites cannaeformis*, and which are shown in inverted position on his plate, from the pointed terminations of their ribs with their small tubercles, we believe must be placed under *C. undulatus*. (Of the other figures given under the name of *Calamites cannaeformis*, fig. 4 might be either *C. undulatus* or *C. suckowi* but fig. 1 and 5 we regard as indeterminate).

The specimen figured by GUTBIER (Zwickau, Pl. 2, fig. 7) under the name of *Calamites cannaeformis* has some similarity in general appearance with *Calamites undulatus* but the large tubercles and the lined furrow dividing the ribs make it impossible to refer this specimen with any degree of certainty to *Calamites undulatus*.

The specimen figured by GEINITZ (Sachsen, p. 5, Pl. 14, fig. 2), under the name of *C. cannaeformis* is difficult to interpret. The fossil which is preserved as a rough sandstone cast, is in the Zwinger Museum, Dresden. The majority of the ribs have blunt terminations, although some are sharp pointed. The figure of GEINITZ has been copied by SCHIMPER (Traité, Atlas, Pl. 20, fig. 3) under the same name. Here the ribs also show much sharper points than on the original itself. It has been referred by RENAULT (Les Plantes fossiles, p. 229, fig. 20) to *Arthropityx gigas*, but the specimen is too imperfectly preserved to admit of any satisfactory determination. It might quite well be the termination of a stem of either *Calamites undulatus* or *C. suckowi*. Its attribution to *C. gigas* is more than doubtful.

Under the name of *Calamites cannaeformis* FEISTMANTEL gives three figures, which we believe belong to *Calamites undulatus*. That given on his Pl. 8, fig. 1 is referred to this species but not without some hesitation. The pointed and flexuous ribs shown on this specimen if accurately representing the characters seen on the fossil leave little doubt as to its belonging to the species under which it is here placed.

The original of his Pl. 8, fig. 2 is given on our Pl. 27, fig. 1 and has already been referred to on a previous page.

If one were to judge from the figure of *Calamites cannaeformis* given by LINDLEY and HUTTON in their Fossil Flora, I, p. 217, Pl. 79, there would be little difficulty in identifying the plant as *C. undulatus*, but when one examines the original which is preserved in the Hutton Collection, Newcastle-on-Tyne and reproduced on our Pl. 33, fig. 3, the identification of the specimen will be seen to be very difficult. A few of the ribs show their terminations, and those which do, end in sharp points and the plant is most probably *C. undulatus*.

Of the two figures of *Calamites cannaeformis* given by DAWSON, (Fossil plants Devon. and Upp. Silurian Form., 1871, p. 26, Pl. 4, fig. 47, 48) the enlargement shown at fig. 48 differs so entirely in the terminations of the ribs from that shown at fig. 47, of which it is presumably a part, that it is difficult to recognise the enlargement as

belonging to the same specimen; the enlargement shows the characters of *Calamites undulatus*, while fig. 47 shows those of *Calamites suckowi*.¹⁾

Of the several figures referred to *Calamites cannaeformis* by ACHEPOHL, (Niederrh. Westf. Steink., p. 30, Pl. 7, fig. 8, p. 47, Pl. 12, fig. 18², p. 47, Pl. 13, fig. 2.) that on his Pl. 12, fig. 18² is most probably *Calamites undulatus* but the others are indeterminate.

Calamites pachyderma has been founded on an old condition of *Calamites undulatus* and is simply an older name for some of the specimens included by STUR in his *Calamites schatzlarensis*. Our fig. 1, Pl. 51 represents a similar condition of the plant. The figures published by GRAND'EURY (Loire, p. 23, Pl. 3, fig. 3; Gard, p. 210, Pl. 14, fig. 11 B) under this name are more in the form of diagrammatic restorations than figures of individual specimens. This plant has been referred to by LESQUEREUX in several of his works but in none of them does he figure it.

The original of BRONGNIART's *Calamites approximatus*, Pl. 24, fig. 1 is illustrated on our Pl. 34, fig. 1, 2, 3. The specimen is a somewhat imperfectly preserved sandstone cast of *C. undulatus* and although badly preserved is quite characteristic of this species.

Although we have not been able to examine the specimen figured by SAUVEUR on his Pl. 2, as *Calamites approximatus*, the sharp pointed ribs and small tubercles and the arrangement of the branch scars leave little doubt in our mind that his plant should be referred to *C. undulatus*. His figure is shown in inverted position.

It might not be thought at first sight that the *Calamites approximatus* figured by GEINITZ (1855) on Pl. 11, fig. 3 belongs to *Calamites undulatus*, but a reference to our Pl. 27, fig. 2, 3 will show that the specimen of GEINITZ simply represents a root portion of *Calamites undulatus* showing the large root scars arranged in verticils.

Probably *C. approximatus* ACHEPOHL (Niederrh. Westf. Steink., Ergänz. Blatt II, fig. 11) should also be included here.

The preservation of the original type of STERNBERG's *Calamites varians* is a most fortunate circumstance for the student of vegetable palaeontology, for this specimen, which has been regarded as an aerial stem for about ninety years is in reality a rhizome bearing an aerial stem. The figure of it given by STERNBERG is slightly enlarged and does not represent the complete specimen. But as we have already referred to this specimen in the description of our Pl. 4, where it is refigured, it need not be again dealt with here. A figure of the original specimen is given by WEISS under the name of *C. varians* var. *inconstans* (Steink. Calam., II, p. 71, Text fig.) which however shows some serious inaccuracies.

The original specimens of *C. varians* GERMAR (1847) are preserved in the Geological

¹⁾ STOPES in The "Fern Ledges" Carboniferous Flora, Memoir 41, Canada. Geological Survey, 1914, p. 15, redescribes DAWSON's specimen. According to the figure, given by her on Pl. 2, fig. 2, the specimen belongs to *C. suckowi*.

Museum at Halle. His fig. 1 had already been published by GERMAR under the name of *C. alternans* (Isis, Pl. 3, fig. 1) and has been refigured by WEISS (*C. varians*, Aus der Steinkohlenfl., Pl. 7, fig. 41; *C. varians insignis* WEISS, Calamarien, II, Pl. 1, fig. 1; SCHENK in RICHTHOFEN, China, IV, Pl. 35, fig. 1, HOFMANN and RYBA, Leitpflanzen, Pl. 1, fig. 2); and is reproduced here on our Pl. 9, fig. 1, 2, 3; Pl. 10, fig. 1, 2. As this specimen has already been fully described on a previous page, it is unnecessary here to refer further to it.

The other two figures given by GERMAR (Pl. 20, fig. 2, 3) under the same name belong to one specimen but a third and central part has been omitted from his figure. The whole specimen however has been figured by WEISS as a pith cast of his *C. varians insignis* in the second volume of his Steinkohlen-Calamarien, Pl. 28, fig. 1. It is very imperfectly preserved and it would be unsafe to refer it definitely to *C. undulatus*. We believe that the fossil represents a rhizome and that the verticils of scars shown on the figure given by WEISS, are root scars and that as oriented on his plate the apical portion of the rhizome is directed to the top margin.

Parts of the original of VON ROEHL's *Calamites varians* (Pl. 1, fig. 1) have been examined at Berlin and the plant is clearly *C. undulatus*.

The specimen figured by WEISS (Pl. 13, fig. 7, 1870) under the name *C. varians* is preserved in the Geological Museum at Strassburg and although it is only a fragment it shows the characters of *C. undulatus* quite distinctly. His figures 1 and 2 on the same plate appear to be too imperfect for a satisfactory determination.

Of *Calamites varians* SCHENK (Pl. 34, fig. 1) and *C. varians insignis* WEISS, (1884, Pl. 1, fig. 2—5) and JONGMANS, (Anleitung I, fig. 77, 77a, 78) though they possibly may belong to *Calamites undulatus*, it is impossible to affirm absolutely that they do belong to that species.

The *Calamites insignis* of RENIER (Docum. Paléont. terr. houill., Pl. 42) only shows a portion of the outer surface of the bark and is in a similar condition to the figures given by WEISS on his Pl. 1, fig. 2—5. It does not possess the necessary data for a specific determination.

The *Calamites roemeri* VON ROEHL (1868) is evidently founded on a small fragment of *C. undulatus*. The sharp pointed ribs with the larger tubercles at their upper ends and the smaller tubercles at their lower ends are quite characteristic of this species. His figure shows the specimen in an inverted position.

The fossil figured by VON ROEHL on his Pl. 1, fig. 4 under the name of *Calamites ramosus* is given natural size on our Pl. 31, fig. 5 and has already been described.

Calamites cisti ACHEPOHL, (Niederrh. Westf. Steink., p. 63, Pl. 18, fig. 14; p. 65, Pl. 19, fig. 6), *C. transitionis* ACHEPOHL, (l. c., p. 14, Pl. 1, fig. 6; Ergänzt. Blatt I, fig. 1), *C. abnormus* ACHEPOHL (l. c., p. 134, Pl. 40, fig. 11, 12), *C. anomalis* ACHEPOHL (l. c., p. 134, Pl. 40, fig. 13) all represent fragmentary or badly preserved specimens and are better considered as indeterminable.

Among the many species made by ACHEPOHL the following, as far as one can judge

from his figures, must be referred to *C. undulatus*: *C. major* ACHEP., *C. duplex* ACHEP., *C. inaequus* ACHEP. and *C. intumescens* ACHEP.

We unite *C. acuticostatus* WEISS with *C. undulatus* as the exceptionally sharp points of some of the ribs of the cast are found to occur on other specimens which without doubt belong to *C. undulatus* (see Pl. 6, fig. 4). The original specimen is reproduced on our Pl. 25, fig. 2, 3, 4 and Pl. 26, fig. 2.

Under the name of *Calamites ramosus* LESQUEREUX (Coalflora, III, p. 702, Pl. 92, fig. 1—4) figures four terminations of Calamite stems. Of these fig. 1 and 2 are indeterminate but fig. 3 and 4 probably belong to *C. undulatus*. Without having examined the original specimens it is however impossible to refer these fossils with any degree of certainty to this species.

STUR, under the name of *Calamites schulzi*, has apparently included several species. The original specimens have been examined. His fig. 2, Pl. 7 *b*, is a rooting part of a stem of *Calamites undulatus* giving off secondary stems and his Pl. 14 *b*, fig. 1 shows a rhizome giving rise to two stems. His Pl. 6, fig. 3 and Pl. 7, fig. 1 and 3 although imperfectly preserved may possibly be referred to *Calamites undulatus*. To *Calamites schulzi* STUR (= *C. arborescens* Aut. [non STERNB.] pars and *C. distachyus* Aut. [non STERNB.] pars) must be referred his Pl. 6, fig. 4 and Pl. 7 *b*, fig. 3 and 4. Text fig. 24 on p. 80 and Pl. 15, fig. 11 are *Sphenophyllum* species, while the following figures, Pl. 6, fig. 1, 2, Pl. 7, fig. 2, 4 and Pl. 7 *b*, fig. 1 are too imperfectly preserved to admit of any specific determination. His restoration of *Calamites schulzi* given at Text fig. 20, p. 67, is merely a hypothetical representation.

TOULA (Die Steinkohlen, 1888) reproduces three of STUR's figures. On his Pl. 5, fig. 15 is a reproduction of the Text fig. belonging to *Sphenophyllum* and fig. 25 is one of the figures referable to *C. distachyus*, while Pl. 6, fig. 6 is a copy of STUR's ideal restoration.

Three of the specimens of *Calamites schützei*, figured by STUR (1887) namely: Pl. 4, fig. 2, 3 and Pl. 4 *b*, fig. 1 and to which belongs Text fig. 38 on p. 143, must be referred to *Calamites undulatus*. The specimen given on Pl. 4, fig. 2, 3 is reproduced on our Pl. 13, fig. 2. Of the other figures given under the former name by STUR (1887) his Pl. 3, fig. 2, 2 *b*, Pl. 4, fig. 1 and Text fig. 34, as well as Text fig. 36 and 37 are too imperfectly preserved for a specific identification. The real *Calamites schützei* STUR as far as we understand it is only represented by a single figure on his plates (Pl. 17, fig. 2.) TOULA (Die Steinkohlen, 1888, Pl. 6, fig. 5) gives a restoration of the species, but the data on which this is founded, are not very obvious.

To *Calamites undulatus* must also be referred the specimen figured by RENIER on his Pl. 39 under the name of *C. schützei* (1910).

Calamites schatzlarensis STUR, appears to be partly founded on large specimens of *C. undulatus*, (Pl. 1, fig. 1, 2) and partly on specimens which are referable to his *C. sachsei* (Pl. 13, fig. 10, 11) and to *C. cisti* BGT. (Pl. 14 *b*, fig. 4).

The specimen of *C. sachsei* figured by STUR (1887) on his Pl. 2 *b*, fig. 1 and which

is in the collection of the Austrian Geological Survey at Vienna, we have been enabled to examine and it undoubtedly belongs to *Calamites undulatus*, though from an examination of his figure one would scarcely be led to this conclusion.

We have considerable difficulty in dealing with the specimens figured by RENAULT (Commentry, 1888) under the name of *Calamites gigas*. These specimens, though representing very large stems, some of which bear verticils of root scars, do not according to our idea have sufficiently sharp pointed ribs for *C. gigas* and have more the character of those of *C. undulatus* with which also the surface ornamentation agrees entirely. Three of his specimens, in whole or in part, are figured in our Pl. 27, fig. 2, 3, 4 and Pl. 28, fig. 1 and these, as well as the other specimens figured by RENAULT, we prefer to remove from *C. gigas* and place them provisionally under *C. undulatus*.

Of the two figures given by RENAULT under the name of *Arthropitys bistrata* neither of the original specimens is well preserved. An examination of the original of his Pl. 52, fig. 3 has shown that any characters that can be observed do not differ from those of *C. undulatus*. The other specimen is so imperfectly preserved that no opinion can be formed as to the species to which it belongs.

Arthropitys stephanensis RENAULT (Commentry) is apparently only a pith cast of *C. undulatus* and of similar character to our specimen figured on Pl. 33, fig. 1, 2.

Through the kindness of ZEILLER we are enabled to refigure the originals of *Calamites leioderma* recorded by him in his Flore de Brive on Pl. 10, fig. 1—3. As these are fully described on a previous page we need not here do more than state that they are undoubtedly referable to *C. undulatus*, a conclusion with which ZEILLER is in complete accord.

Among all other figures published under the name of *C. leioderma* or under that of *C. cisti* and referred to *C. leioderma* by various authors, there is not one possessing determinable characters. In not a single case do these specimens exhibit characters from which it is possible to draw up a diagnostic description of this supposed species. *C. leioderma* GUTBIER, Verst. d. Rothl. in Sachsen, p. 8, Pl. 1, fig. 5; GOEPPERT, Flora d. Perm. Form., Palaeontogr., XII, 1864—65, p. 34, Pl. 3, fig. 1 (The original of this figure has been examined in the Geological Museum at Breslau); TWELVETREES, Q. J. G. S. London, XXXVIII, 1882, p. 499, Pl. 21, fig. 1; STEFANI, Flora carbon. e permiana della Toscana, 1901, p. 66, Pl. 9, fig. 9, Pl. 10, fig. 1.

C. cf. leioderma ZEILLER, Note sur la fl. houill. du Chansi, Ann. des Mines, 1901, XIX, 4, p. 7, Pl. 7, fig. 9.

C. infractus var. *leioderma* GEINITZ, Dyas, II, 1862, p. 135, Pl. 25, fig. 3, 4.

C. dürri GUTBIER, Verst. d. Rothl. in Sachsen, p. 8, Pl. 1, fig. 6. The original specimen has been examined in the collection of the Geological Survey at Leipzig.

C. cisti STERZEL, Flora des Rothl. im nordw. Sachsen. Pal. Abh. Dames u. Kayser, III, 4, 1886, p. 12 (246), Pl. 1 (21), fig. 8; Pl. 2 (22), fig. 1—3; Pl. 3 (23), fig. 1. The original of Pl. 2, fig. 3 may represent a badly preserved *C. cisti* and has as several of the other original specimens of STERZEL been examined in the collection of the Geological Survey at Leipzig.

C. cisti RACIBORSKI, Permokarb. Flora, Rozpraw Wydz. mat. przyr. Akad. Um. w Krakowie, XXI, 1891, p. 13 (365), Pl. 1, fig. 1, 2.

C. cisti STERZEL, Rotlieg. im Plauenschen Grunde, Abh. der math. phys. Classe der K. Sächs. Ges. d. Wissensch., XIX, 1893, p. 94, Pl. 9, fig. 5, 6.

We may mention here that although it is impossible to express any definite opinion as to which species the *Arthropitys communis* figured by FELIX (Földtani Közlöny, XXVI, 1896, p. 169, Pl. 4) may be referred, the sharp terminations of the ribs and small tubercular openings show a great similarity to those of *Calamites undulatus*.

The fossil figured by STEINHAEUSER under the name of *Phytolithus parvatus*, on his Pl. 6, fig. 1, is the oldest figure in the literature of the *Calamites* which shows the outer surface of the cortex of *Calamites undulatus* or in fact, of any other species of the genus.

From the specimen we have described above (Pl. 9, fig. 5) it is obvious that the *Cyclocladia major* L. et H. is founded on an underground portion of a stem or rhizome of *Calamites undulatus*.

The *Hippurites gigantea* as figured by EICHWALD (Leth. rossica, I, p. 190, Pl. 14, fig. 4) is not the *Hippurites gigantea* of LINDLEY and HUTTON (Fossil Flora, Vol. II, p. 87, Pl. 114) which may possibly be referable to *Calamites undulatus* though it is impossible, on account of the fragmentary condition of the type, to refer it definitely to any given species. LINDLEY and HUTTON's type is shown natural size on our Pl. 139, fig. 2.

Affinities:

With well preserved specimens it would be very difficult to confuse *Calamites undulatus* with any other Upper Carboniferous species. It differs from *C. suckowi* in frequently having flexuous and distinctive sharp pointed ribs, smaller tubercles at their upper ends, their surface ornamentation of the ribs, and in the periodic distribution of the branch scars.

Its closest ally is *C. haueri* from the Lower Carboniferous in which also the ribs terminate in sharp points and are sometimes flexuous but they have larger tubercles and many of the ribs do not alternate at the nodes. But above all it is distinguished from this species by the form and distribution of the branch scars.

The differences between *C. undulatus* and *C. wedekindi* and allied species will be found in the notes where these latter are described.

DISTRIBUTION.

Permian.

Germany.

Saar Basin.

Horizon: Lebacher Schichten.

Localities: Schwarzenbach near Birkenfeld. (*C. varians* WEISS, 1871, Pl. 13, fig. 7); Quarry near Steinbach. (Geol. Landesanstalt, Berlin).

Carboniferous.

Great Britain.

Radstockian Series.

Horizon: Base of Keele Group.

Locality: Hartshill, North Staffordshire.

Horizon: "Red Beds", Keele Group.

Locality: Barony Pit, Oldbyres Farm, 1½ miles west of Auchinleck, Ayrshire.

Horizon: 2nd Division Coal.

Locality: Forest of Dean, Gloucestershire. (ARBER, 1912, Pl. 13, fig. 16; JONGMANS, 1911, fig. 73).

Staffordian Series.

Horizon: Two feet or Little Toad Seam, New Rock Group.

Locality: Deep Pit, Kingswood, near Bristol. (Collected by T. STOCK).

Horizon: No. 2. Rhondda Seam.

Localities: Cambrian Collieries, Clydach Vale, Rhondda, Glamorganshire. (Collected by D. DAVIES).

Standard Collieries, Gnyshir, Glamorgan. (Collected by R. WEED).

Old Tip, 1¾ miles north east of Resolven Station, Glamorganshire. (Coll. Geol. Survey of England).

Horizon: Newcastle Group.

Locality: Claverley Boring, 1½ miles S. S. E. of Claverley, near Bridgenorth, Shropshire. (Coll. Geol. Survey of England).

Westphalian Series.

Common.

(Specimens figured here and others of which we have seen the originals).

Horizon: ?

Locality: Cliff above Bideford Railway Station. (ARBER, 1904, Pl. 19, fig. 1, 3).

Horizon: Upper Chevet Rock.

Locality: Darfield, Yorkshire. (Pl. 33, fig. 1, 2).

Horizon: Between Deep Hard and Silkstone Coals.

Locality: Bonds Main Colliery near Chesterfield, Derbyshire. (Pl. 8, fig. 2).

Horizon: Barnsley Thick Coal.

Localities: Monckton Main Colliery near Barnsley, Yorkshire. (Pl. 30, fig. 4).

Woolley Colliery, Mapplewell near Barnsley, Yorkshire. (Pl. 32, fig. 2).

Horizon: Outcrop of Arley Mine.

Locality: Brickwork, Hibson Road, Marsden Height, Nelson, Lancashire. (Pl. 8, fig. 1; Pl. 28, fig. 3; Pl. 29, fig. 1).

Horizon: Bensham Seam.

Locality: Jarrow, County of Durham. (*Cyclocladia major* L. et H., Pl. 130; our Pl. 33, fig. 4).

Horizon: ?

Localities: Longmoor, Yorkshire. (Original of *C. decoratus* BGT., Pl. 14, fig. 3; our Pl. 10, fig. 4, 5).

“Newcastle”. (Original of *C. approximatus* BGT., Pl. 24, fig. 1; our Pl. 34, fig. 1, 2, 3; *C. suckowi* BGT., Pl. 15, fig. 1; our Pl. 32, fig. 1).

Lanarkian Series.

Frequent.

Horizon: ?

Locality: Olive Branch Pit sinking, Fisherrow near Musselburgh, Midlothian. (Pl. 34, fig. 4; Pl. 35, fig. 1, 2).

Horizon: Splint Coal, No. 6.

Locality: Woodhill Pit, Kilmaurs, Ayrshire. (Pl. 26, fig. 3).

Horizon: Kiltongue Coal.

Locality: Inkerman Pit, Airdrie, Lanarkshire. (Pl. 9, fig. 5).

Netherlands.

Westphalian Series.

Horizon: Equivalents of the “Gaskohle, Fettkohle and Magerkohle” of the Rheno=Westfalian=Basin.

Localities: In different borings in Limburg and in the Peel=Basin.

Equivalent of the Lower “Fettkohle” of the Rheno=Westfalian=Basin.

Common.

Horizons: Seam IV, (Pl. 25, fig. 1; Pl. 26, fig. 1; Pl. 7, fig. 2); Seam V, (Pl. 1, 2, 3; Pl. 6, fig. 1—5; Pl. 7, fig. 1; Pl. 10, fig. 3; Pl. 13, fig. 2; Pl. 14, fig. 1, 2; Pl. 20, fig. 1; Pl. 30, fig. 1, 2; Pl. 35, fig. 3, 4; Pl. 36, fig. 1—5; Pl. 37; Pl. 38, fig. 1); Seam VI, (Pl. 19, fig. 1, 2); Seam VIII.

Locality: Wilhelmina Colliery, near Heerlen, Limburg.

Horizons: Seam V, (Pl. 19, fig. 3); Seam VIII.

Locality: Laura en Vereeniging Colliery, near Heerlen.

Horizons: Seam IV; Seam V.

Locality: Oranje Nassau I Colliery, Heerlen.

Horizons: Seam Groot Athwerk; Seam Senteweck.

Locality: Domaniale Mijn, Kerkrade.

Horizon: Shale over Seam II, at 228 m.

Locality: Emma Colliery, near Heerlen.

Germany.

Common in the different basins. We mention here only a few localities from which we have been able to examine the specimens.

Basin of Aachen.

Westphalian Series.

Horizons: Seam Gross Langenberg and Seam Gross Meister.

Locality: Gouley Colliery. (Rijks Opsporing, Leiden).

Horizon: Seam Plattkohl.

Locality: Eschweiler Reserve. (Geol. Landesanst., Berlin).

Horizon: ?

Locality: Centrum Colliery, near Eschweiler. (Geol. Landesanst., Berlin).

Rheno=Westfalian Basin.

Westphalian Series:

For localities cf. JONGMANS and KUKUK, Calam. Rhein. Westf. Kohlenbeckens. Mededeel. Rijks Herbarium, Leiden, No. 20, 1913, pp. 16—19.

Boring Niederrhein 80, 58 and 98, Hammerbruch near Sonsbeek. (Geol. Landesanst., Berlin).

Saar=Basin.

Upper Westphalian Series.

Locality: Duttweiler near Saarbrücken. (*C. acuticostatus* WEISS, Pl. 25, fig. 2, 3, 4; Pl. 26, fig. 2; *C. sinuatus* GOLDENBERG, Pl. 29, fig. 2).

Baden.

Stephanian Series.

Horizon: Ottweiler Schichten.

Locality: Hinterohlsbach. (STERZEL, 1907, Pl. 19, fig. 1).

Westphalian Series.

Locality: Offenburg. (STERZEL, Pl. 57, fig. 2a).

Basin of Wettin-Löbejün.

Stephanian Series.

Horizon: Obere Ottweiler Schichten.

Localities: Wettin. (*C. varians insignis* WEISS, Pl. 9, fig. 1, 2, 3; Pl. 10, fig. 1, 2; Pith cast, Pl. 21, fig. 1).

Löbejün. (Geol. Museum, München).

Saxony.

Westphalian Series.

Localities: Zwickau, Segengottes-Pit. (*C. cannaeformis* GEINITZ).

Oberhohndorf. (*C. approximatus* GEINITZ, Pl. 11, fig. 3).

Otto-Pit, Nieder Niessling. (Museum Chemnitz).

Lower Silesia.

Westphalian Series.

Horizon: Schatzlarer Schichten.

Localities: Neurode. (*C. schulzi* STUR, Pl. 7 b, fig. 2; Pl. 14 b, fig. 1).

Waldenburg. (*C. schützei* STUR, Pl. 4 b fig. 1).

Melchior-Pit near Dittersbach. (Geol. Landesanst., Berlin).

Waldenburg, Middle Division of the western Fuchs-Colliery. (*C. schatzlarensis* STUR, Pl. 1, fig. 1).

Upper Silesia.

Westphalian Series.

Horizon: Rybnitzer Schichten.

Localities: Boring Königin Luise III near Orzinowitz. (Geol. Landesanst., Berlin, Pl. 26, fig. 4).

Boring Königin Luise IV b. (Geol. Landesanst., Berlin).

Horizon: Randgruppe.

Locality: Boring Paruschowitz II, 184 m. (Geol. Landesanst., Berlin, Pl. 30, fig. 3).

Horizon: Muldengruppe.

Localities: Orzesche, Seam Leopold. (STUR, *C. schatzlarensis*, Pl. 2 b, fig. 1).

Heinrichglück-Colliery near Nikolai, Nieder-Seam. (Geol. Landesanst., Berlin).

Horizon: Mittlere Sattelfeldpartie.

Locality: Boring Wessola, 340 m., near Colliery Jungfrau X, Donnersmarckhütte. (Geol. Landesanst., Berlin).

Bohemia.

Stephanian Series.

Locality: Max Karl Pit near Pilsen. (Pl. 51, fig. 1; Historisches Museum, Pilsen).

Westphalian Series.

Localities: Radnitz. (Original STERNBERG, *C. varians*, Pl. 12, our Pl. 4; Bohemian Museum, Prag).

Bras near Radnitz. (Geolog. Landesanst., Berlin, Pl. 44, fig. 1; HOFMANN and RYBA's, Pl. 1, fig. 7).

Wranowitz. (ETTINGSHAUSEN, Radnitz, Pl. 3, fig. 1).

Mosstitz. (ETTINGSHAUSEN, Radnitz, Pl. 3, fig. 3).

(Without locality), (*C. cannaeformis*, FEISTMANTEL's Pl. 8, fig. 2, our Pl. 27, fig. 1; Bohemian Museum, Prag).

Horizon: Schatzlarer Schichten.

Localities: Schatzlar in the "Josephi Stollen", Upper Friedrich-Seam. (*C. schatzlarensis*, STUR's Pl. 1, fig. 2).

Schwadowitz. (*C. suckowi*, STUR's Pl. 14, fig. 1, our Pl. 28, fig. 2).

Orlau, Altmaschinen-Pit, Roof of the "Mächtiges Flötz". (*C. schützei*, STUR's Pl. 4, fig. 2, 3, our Pl. 13, fig. 1).

Belgium.

Westphalian Series.

Common.

Horizon: Seam Grande Pucelle.

Locality: Colliery Sart d'Avette, Pit Horion. (*C. schützei*, RENIER, 1910, Pl. 39).

Horizon: Seam Duchesse.

Locality: United Collieries of Charleroi, Pit No. 12. (RENIER, 1910, Pl. 44).

Horizon: ?

Locality: United Collieries of Charleroi, Pit No. 7. (Collection Université, Liège).

Horizon: Seam l'Olive.

Locality: Mariemont Collieries, Pit Placard, (Coll. DELTENRE).

Horizons: Seam du Parc and Seam de Derrière.

Locality: Mariemont Collieries, Pit Réunion. (Pl. 15, fig. 2, 3). (Coll. DELTENRE).

Horizon: Seam François.

Locality: Mariemont Collieries, Pit St. Edouard. (Coll. DELTENRE).

Horizon: Seam Dure Veine.

Locality: Colliery John Cockerell, Pit Collard. (Coll. Université, Liège).

Horizon: Seam Houlleux.

Locality: Colliery Bois d'Avroy, Pit Grand Bac. (Coll. Université, Liège).

France.

Westphalian Series.

Common.

Localities: Département du Nord: Faisceau maigre, Faisceau demigras and Faisceau gras. (Collieries of Anzin, Pit Thiers, 3^d Southern Seam, Pl. 54, fig. 4 of ZEILLER, Valenciennes; École supér. des Mines, Paris).

Département du Pas de Calais: Faisceau maigre, Faisceau gras. (Collieries of Meurzin, Pl. 54, fig. 1 of ZEILLER, Valenciennes; École supér. des Mines, Paris).

Bassin de Commentry.

Stephanian Series.

Localities: Trench of "l'Espérance" in the "Banc des Roseaux". (*Arthropitys gigas* RENAULT, our Pl. 27, fig. 2, 3; Musée d'Hist. nat. Paris).

Colliery of Montvicq. (*Arthr. gigas* RENAULT, our Pl. 28, fig. 1; Musée d'Hist. nat. Paris).

Trench of "Forêt" in the shales intercalated in the Second Seam. (*Arthr. gigas* RENAULT, our Pl. 27, fig. 4; Musée d'Hist. nat. Paris).

Trench of Saint Edmond at 3 M. above the roof of "la Grande Couche". (*Arthr. bistriata* RENAULT; Musée d'Hist. nat. Paris).

Colliery of Montrambert. (*Arthr. stephanensis* RENAULT; Musée d'Hist. nat. Paris).

Bassin du Gard.

Locality: Colliery of Fontanes, Niveau Smet, Seam No. 4. (École supér. des Mines, Paris, Pl. 21, fig. 2; Pl. 22).

Bassin de Brive.

Stephanian Series.

Locality: Pits of Larche, Niveau at 206 m. (*C. leioderma*, ZEILLER, *C. varians*, ZEILLER, *C. undulatus*, ZEILLER; our Pl. 11, fig. 1, 2; Pl. 12, fig. 1, 2; École supér. des Mines, Paris).

United States.

Arkansas (LESQUEREUX, 1860).

Canada.

Millstone Grit (DAWSON, 1873).

CALAMITES STEINHAUERI STERNBERG.

Pl. 88, fig. 1; Text fig. 20.

- 1825 *Calamites steinhaueri* STERNBERG, Versuch, I, 4, Tentamen, p. XXVII.
1828 *Calamites steinhaueri* BGT., Histoire, I, Livr. 2, p. 135, Pl. 18, fig. 4.
1845 *Calamites steinhaueri* UNGER, Synopsis, p. 23.
1850 *Calamites steinhaueri* UNGER, Gen. et spec., p. 48.
1818 *Phytolithus sulcatus* STEINHAUER, Trans. Amer. Phil. Soc.,
N. S., I, p. 277, Pl. 5, fig. 1, (non fig. 2).

DESCRIPTION.

Stem termination only known. Internodes broader than long, decreasing towards the base. Ribs at the extreme base very short, as broad as long, subquadrate, with a large terminal tubercle and divided by straight furrows. Surface of ribs ornamented with cross-hatching. Terminations of ribs in some cases pointed, in other cases blunt.

REMARKS.

The specimen shown on our Pl. 88, fig. 1 shows portions of a rhizome and a base of a stem. The rhizome undoubtedly belongs to *Calamites undulatus* but unfortunately the base of the stem is not in organic connection with it though most probably it also belongs to *Calamites undulatus* as the surface of the ribs shows the characteristic cross-hatching of that species and a few of them terminate in sharp points.

While having some doubt in referring this specimen definitely to *Calamites undulatus*, we have no difficulty in identifying it with the *Calamites steinhaueri* of STERNBERG and although we think it probable

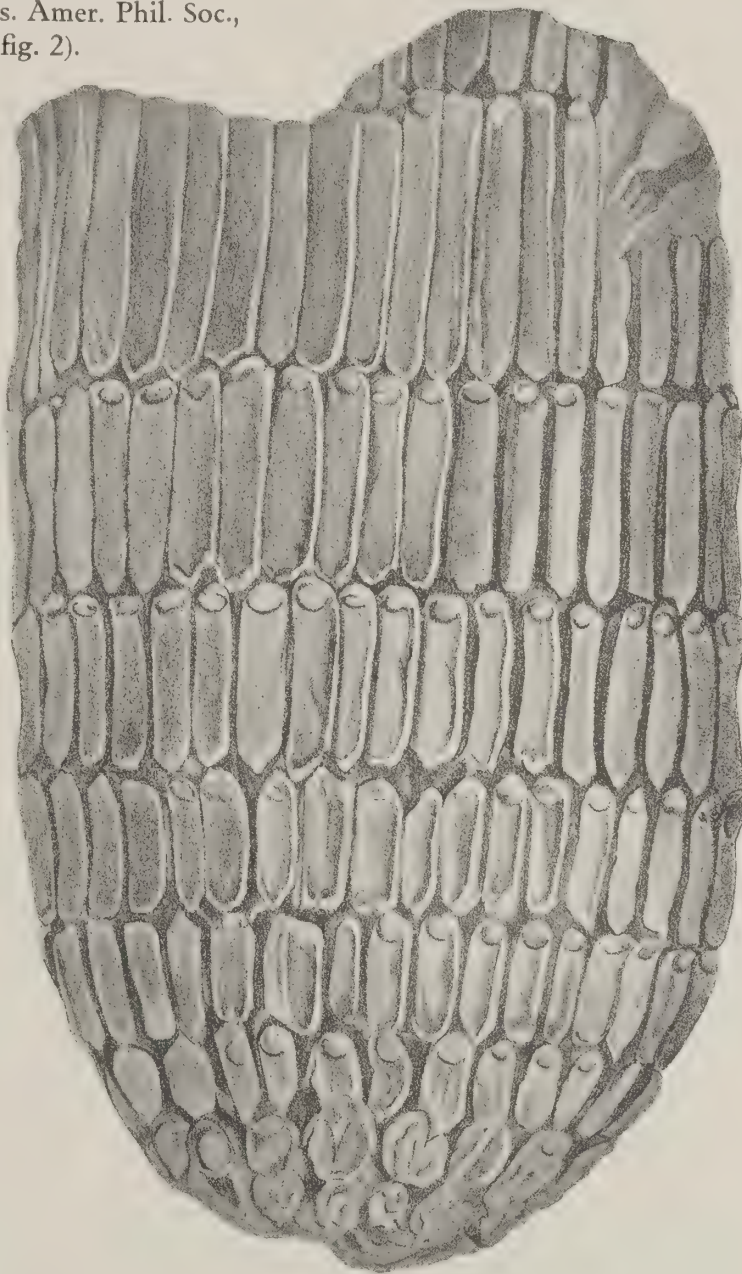


Fig. 20.

Calamites steinhaueri STERNB.
(Copied from BRONGNIART, Pl. 18, fig. 4).

that that species is a basal portion of a stem of *Calamites undulatus*, until we have clearer evidence on this point we prefer to treat *Calamites steinhaueri* provisionally as a distinct species.¹⁾

DISTRIBUTION.

Great Britain.

"Carboniferous", Yorkshire. (STEINHAEUER). (Text fig. 20).

Westphalian Series.

Horizon: Outcrop of Arley Mine.

Locality: Brickwork, Hibson Road, at Marsden Height, Nelson, Lancashire.

Collected by Mr. P. WHALLEY. (Pl. 88, fig. 1).

CALAMITES WEDEKINDI WEISS.

Pl. 40, fig. 3; Pl. 41, fig. 4; Pl. 43, fig. 2, 3, 5.

1884 *Calamites wedekindi* WEISS, Steinkohlen-Calamarien, II, p. 88, Pl. 17, fig. 1.

1911 *Calamites wedekindi* JONGMANS, Anleitung, I, p. 98, fig. 97.

1913 *Calamites wedekindi* JONGMANS and KUKUK, Calam. Rhein. Westf. Steink., Mededeel. Rijks Herbarium, Leiden, No. 20, p. 35, Pl. 13, fig. 4

1884 *Calamitina wedekindi* WEISS, Steinkohlen-Calamarien, II, Atlas, Explanation of Pl. 17, fig. 1.

1887 *Calamites schützei* STUR, (pars), Calam. schatzlarer Schichten, p. 131, 144.

DESCRIPTION.

Width of stem unknown. Internodes very short about 1,5 cm. long. Period of branch scars unknown. Leaf scars elongate-oval, catenulate with central vascular cicatrice. Leaves about the length of the internode or rather shorter, setaceous-lanceolate. Branch scars immediately below the nodal line, transversely oval 1 to 1,2 cm. broad, 6—7 mm. high, somewhat irregular in form, touching laterally or more or less distant, umbilical scar central, surrounded by an oval furrow. Outer surface of stem smooth or bearing short irregular transverse wrinkles which are somewhat broken up by a faint ribbing.

REMARKS.

The original specimen described by WEISS is refigured here on Pl. 41, fig. 4. Two others from the collection of DELTENRE are given on Pl. 40, fig. 3 and Pl. 43, fig. 2, 3 and a fourth example from the "HUTTON Collection" is shown on Pl. 43, fig. 5.

¹⁾ ETTINGSHAUSEN in HAIDINGER's Nat. Abh., IV, I, 1851, p. 74, has united *C. decoratus* BGT. (= *C. undulatus*) with *Calamites steinhaueri* BGT.

The best specimen is that given on Pl. 43, fig. 2, 3. It not only shows the whorl of branch scars but also parts of six nodes which bear the foliage. The foliage is particularly well shown on the impression of this specimen given at fig. 3. The leaves are rigid, setaceous, about 2 cm. long and are therefore slightly longer than the internode. One cannot doubt that these leaves are shown in their original position and that the branch scars occur immediately below the node, as clearly seen in this specimen. Four branch scars are present at the bottom of this example. They are more or less transversely oval with a central umbilicus surrounded by a furrow, which follows the contour of the scar. The internodes are about 1,5 cm. long and of almost equal breadth.

The original specimen of WEISS is refigured on Pl. 41, fig. 4. Owing to the presence of the foliage on the specimen seen on Pl. 43, fig. 2, 3, it has been necessary to orient the original type in a direction inverse to that given to it by WEISS, as it is now known, that the branch scars occurred below and not above the nodal line. This example also shows very short internodes of almost equal width, which are only about 1,5 cm. long. Some decay has evidently taken place in the specimen before fossilization, for in addition to it showing the branch scars and somewhat imperfectly preserved leaf scars, the ribbing of the inner zone of the stem is faintly shadowed on the surface. The branch scars are irregular in shape, free or touching each other laterally and even partially overlapping. They show the inner circle surrounding the umbilicus, which is characteristic of this species.

The specimen given on Pl. 40, fig. 3 has three branch scars placed almost equally distant but then a gap occurs which shows that the other members of the whorl must have held very irregular positions in regard to them. The remains of the leaf scars are present as well as the transverse wrinkles on the cortex.

The fourth and last example of this species known to us, is given on Pl. 43, fig. 5, which shows five internodes. That on which the branch scars are situated is the shortest, measuring only about 1,25 cm., while the other internodes are 1,5 cm. long. It appears from this specimen and also from that shown on Pl. 40, fig. 3, that the branch bearing internode is the shortest in the period. The upper margins of the branch scars in this example are somewhat flattened against the nodal line and in this respect they show a superficial resemblance to those of *C. semicircularis*, but they possess the inner circle surrounding the umbilicus, characteristic of *C. wedekindi*, as well as the short internodes of almost equal length and the transverse wrinkling of the cortex.

The differences between these two species stand out very clearly when the figure of this specimen (Pl. 43, fig. 5) is compared with those of *C. semicircularis* given at fig. 1 of Pl. 43, and fig. 4, Pl. 40.

The position of the branch scars, as well as their form and the equality in the length of the internodes, at once separate this species from *C. undulatus*, *C. goepperti*, *C. sachsei*, *C. schützei* and *C. verticillatus*.

The specimen from Rubengrube near Neurode, recorded by WEISS as *C. wedekindi* is shown on our Pl. 38, fig. 3, unfortunately in inverted position. The form of the scars

with their eccentric umbilicus shows that they arise immediately above the nodal line and that the specimen is possibly a somewhat abnormal example of *C. goepperti*.

A specimen given on Pl. 29, fig. 3 has in some respects a certain resemblance to *C. wedekindi* but none of the branch scars is sufficiently well preserved to enable one to institute a critical comparison between them and those of *C. wedekindi*. The specimen itself does not afford any clear evidence as to its true orientation, but if it be *C. wedekindi* than it is shown in inverted position on our plate. (*Locality*: Westphalian Series, Belgium, Levant de Flénu, Cuesmes; Musée d'Hist. nat., Bruxelles).

DISTRIBUTION.

Westphalian Series.

Great Britain.

Horizon: Bensham Seam.

Locality: Yarrow, County of Durham. (Pl. 43, fig. 5; HUTTON's Collection, Newcastle-on-Tyne).

Germany.

Rheno-Westfalian Coalfield.

Horizon: Fettkohle.

Locality: Colliery Bruchstrasse near Langendreer. (Pl. 41, fig. 4; Geol. Landesanstalt, Berlin).

Belgium.

Horizon: Seam du Parc.

Locality: Mariemont Collieries, Pit Réunion. (Pl. 40, fig. 3; Pl. 43, fig. 2, 3; Coll. DELTENRE).

CALAMITES SEMICIRCULARIS WEISS.

Pl. 40, fig. 4; Pl. 42, fig. 1—5; Pl. 43, fig. 1, 4; Pl. 44, fig. 2, 3, 4; Pl. 45, fig. 1—3;
Pl. 46, fig. 1—4; Pl. 47, fig. 2—6; Pl. 48, fig. 2; Pl. 49, fig. 1.

1910 *Calamites semicircularis* RENIER, Docum. Paléont. terr. houill., p. 17, Pl. 41.

1911 *Calamites semicircularis* JONGMANS, Anleitung, I, p. 99, fig. 98.

1884 *Calamites (Calamitina) varians semicircularis* WEISS, Steinkohlen-Calamarien, II, p. 75, Pl. 16, fig. 6.

1904 *Calamites cf. varians semicircularis* RYBA, Jahrb. k. k. geol. Reichsanstalt, LIII, p. 359, Pl. 16, fig. 3.

1855 *Calamites communis* ETTINGSHAUSEN, (pars), Radnitz, Abh. k. k. geol. Reichsanst., II, p. 24, Pl. 1, fig. 1, 2.

1868 *Cyclocladia major* K. FEISTMANTEL, (pars), Abh. k. Böhm. Ges. der Wissensch., (6), II, p. 5, Pl. 1, fig. C, (non fig. B).

- 1874 *Cyclocladia major* O. FEISTMANTEL, (*pars*), Böhmen, Pl. 2, fig. 1, 2, (*non* Pl. 1, fig. 8).
 1874 *Cyclocladia major* O. FEISTMANTEL, Studien, Abh. k. Böhm. Ges. d. Wiss., (6), VII, Pl. 1, fig. 1.
 1874 ? *Equisetites infundibuliformis* O. FEISTMANTEL, (*pars*), Böhmen, Pl. I, fig. 2.
 1901 *Calamites verticillatus* KIDSTON (*non* L. et H.), Flora Carbon. Period, Proc. Yorksh. Geol. and Polytechn. Soc., XIV, p. 200, Pl. 36, fig. 4.

DESCRIPTION.

Stem attaining a large size. Internodes varying in length. Branch scars periodic, subcircular, semilunar or peltate with the upper margin generally more or less flattened and attaining a breadth of rather more than 1 cm., sometimes broader than long, verticillate, irregularly placed and situated below the nodal line. Upper margin flattened by the nodal line or extending above it. Umbilicus slightly above the centre of the scar or even touching its upper margin. Internode on whose upper end the branch scars are placed is generally the shortest in the period.

Leaf scars consisting of a distinct vascular cicatrice with prolonged lateral wings which overlap or whose sharp points, flattened by mutual pressure give the appearance as that of a band connecting the slightly distant circular cicatrices.

Outer surface of cortex finely longitudinally fibrillous. On older stems it becomes irregularly longitudinally wrinkled and cracked, with occasionally fine transverse wrinklins.

Pith cast ribbed, furrows straight, terminations of ribs and tubercles obscure.

Umbilicus of branch scars placed on the nodal line to which on the pith cast four or five of the ribs converge from each side of the node.

REMARKS.

The first specimens belonging to this species were figured by ETTINGSHAUSEN under the name of *Calamites communis* and a portion of the specimen originally given by him on his Pl. 1, fig. 1, (all that is now preserved of it,) is reproduced here on Pl. 43, fig. 4.

The type of WEISS, which was originally figured by FEISTMANTEL under the name of *Cyclocladia major* is also given here on Pl. 40, fig. 4. Both these specimens show the semicircular form of the branch scar. The example figured by FEISTMANTEL and WEISS exhibits very beautifully the leaves which are still attached to the node. This specimen therefore clearly shows that the branch scars occur upon the upper end of the internode.

Judging by the size of the scars probably the youngest example we have is that shown on Pl. 42, fig. 1. The scars here are very small being only 5 mm. in diameter. An enlargement of a portion of this specimen is given on the same plate at fig. 2 where the scars can be more clearly observed. They are oval with flattened upper margin and can scarcely be said to extend above the nodal line. This figure also shows very well the fibrillous structure of the bark.

A slightly older example is seen on Pl. 46, fig. 3 of which the impression is given on Pl. 48, fig. 2. Here the branch scars are slightly larger and measure 7 mm. in their transverse diameter. They are also flattened at their upper margins and cause an upward displacement of the nodal line. This is well seen on the enlargement given on Pl. 46, fig. 4, which also shows the fibrillous texture of the outer surface of the cortex.

A still older individual is given on Pl. 47, fig. 2, of which some of the scars are enlarged at fig. 3. Their variation in form from almost circular to subtriangular, with rounded angles is very well seen on this figure.

Another example on which the scars are almost circular is given on Pl. 46, fig. 2. The branch scars here press the nodal line upwards and the umbilicus can be seen to occupy a position almost directly on the nodal line.

Pl. 47, fig. 6 shows a small fragment with almost cordate scars. Their umbilicus is situated very near to their upper margin.

Passing on to stems of greater age with larger scars, that given on Pl. 47, fig. 4, shows subcordate branch scars, which in this case are approximated. This example shows better than any we have seen the form of the leaf scars, of which an enlargement is given at fig. 5, Pl. 47. The leaf scar consists of a central circular impression occupying the whole width of the band on which it sits and which at its sides has two lateral expansions or wings, the points of which sometimes overlap with the neighbouring leaf bases or they become flattened by mutual pressure. The result being that the circular scars appear as if they were placed upon a band which connects them together.

The specimen given on our Pl. 40, fig. 4, which has already been figured by FEISTMANTEL and WEISS, also shows the leaf scars but they are somewhat imperfectly preserved and do not so clearly exhibit the circular cicatrice as in that given on Pl. 47, fig. 5.

The leaf scars are also present on the example figured on Pl. 42, fig. 3 of which an enlargement is seen at fig. 4. Here also their true structure is not preserved. The outer surface of this specimen, fig. 3, shows a curious combination of coarse longitudinal wrinkling on the upper part of one of the internodes while the other portion of the same internode bears fine transverse wrinklins.

An example resembling in many respects the type specimen has been found in the Dutch Colliery Oranje Nassau I, slightly above the position of Seam B. With one exception the scars of the only and still fragmentary verticil are semicircular with flattened upper margins. The umbilicus is eccentric.

The most interesting point in this specimen is the presence of large scars, probably those of root scars. One is placed on the nodal line directly below the verticil of branch scars and two are on the second nodal line. They are subcircular, somewhat longer than broad and agree in every respect with those on the specimen of *C. undulatus* figured on Pl. 157, fig. 5. Above the lowest node on this example there occur oval depressions similar to those described when dealing with *C. goepperti* (Pl. 55, fig. 2). They are also probably due to fungal agency.

A specimen illustrating the foliage is given on Pl. 44, fig. 2. This example shows distinctly the form of the leaves which is narrow lanceolate; their widest portion being at their extreme base.

Portions of more aged stems are given on Pl. 42, fig. 5, Pl. 44, fig. 3, and Pl. 49, fig. 1. That on Pl. 42, fig. 5 shows two complete scars and a portion of a third scar, placed about 1,5 cm. apart from each other. Of the two perfect scars one is subcircular the other transversely oval. Of the two scars on the specimen shown on Pl. 49, fig. 1, one is subcordate with the umbilicus placed towards its upper margin, but the other is imperfectly preserved. An example exhibiting longitudinal cracking of the cortex is given on Pl. 44, fig. 3. Here again one of the two scars shown on the specimen is more circular than the other. The outer surface of the bark shows the usual fibrillous longitudinal striations.

Two specimens with very large subcordate branch scars are given on Pl. 45, fig. 3 and Pl. 46, fig. 1. The scar on the larger of these two examples is fully three centimetres long and rather less than three centimetres wide. The scars are irregularly placed and subcordate. The other fossil on Pl. 46, fig. 1 has longer internodes but the branch scars are of the same shape as those just mentioned though more distant. The bark is longitudinally and irregularly furrowed. A fragment of a similar stem has been found in the Dutch Colliery Wilhelmina, Seam V.

The only pith cast we have seen of this species is that shown on Pl. 44, fig. 4 and Pl. 45, fig. 1. This cast belongs to the impression seen on Pl. 43, fig. 1. The impression shows the ordinary semilunate branch scars, which are seen with equal clearness on the cast Pl. 45, fig. 1. The straight ribs converge towards the umbilicus of the branch scars where they meet in a small point at its centre, which latter coincides with the nodal line.

Fig. 4, Pl. 44, gives part of the other side of the cast just described. This shows the convergences of the ribs towards the node but otherwise affords little indication of the presence of the branch scars.

The terminal tubercles are not exhibited nor are the terminations of the ribs clearly seen except at the one place where they end in rectangular points. The surface of the ribs appears to be smooth.

A peculiar example of this species is shown on Pl. 45, fig. 2. A certain amount of decay seems to have taken place in this specimen before fossilization occurred, for the ribs are seen shadowed through a thin film of carbonaceous matter. Two branch scars are present, which are somewhat flattened on their upper margin. They are succeeded by a very long internode immediately above them, which measures over 12 cm.

Calamites semicircularis is distinguished from *C. wedekindi* in the form of the branch scars, being semicircular or subcordate and in the absence of the second inner circle of the scar.

DISTRIBUTION.

Great Britain.

Westphalian Series.

Horizon: Barnsley Thick Coal.

Localities: Monckton Main Colliery, Barnsley, Yorkshire. (Pl. 46, fig. 2). Collected by W. HEMINGWAY.

Oaks Colliery, Barnsley, Yorkshire. (Pl. 45, fig. 2). Collected by W. HEMINGWAY.

Lanarkian Series.

Locality: Crophead Pit, Sauchie near Alloa, Clackmannanshire. (Pl. 43, fig. 1; Pl. 44, fig. 4; Pl. 45, fig. 1).

Netherlands.

Westphalian Series.

Equivalent of the Lower "Fettkohle" of the Rheno-Westfalian=Basin.

Horizon: Seam VIII.

Locality: Laura en Vereeniging Colliery near Heerlen, Limburg. (Pl. 42, fig. 1, 2; Pl. 46, fig. 3, 4; Pl. 47, fig. 2, 3; Pl. 48, fig. 2).

Horizon: Seam V.

Locality: Wilhelmina Colliery, near Heerlen.

Belgium.

Westphalian Series.

Mariemont-Collieries.

Horizon: Seam Lahestre.

Locality: Pit Placard. (Pl. 46, fig. 1, Collection DELTENRE).

Horizon: Seam Dure.

Locality: Pit St. Arthur. (Pl. 44, fig. 2, 3, Collection DELTENRE).

Horizon: Seam de Derrières.

Locality: Pit Réunion. (Pl. 42, fig. 3, 4, 5, Collection DELTENRE).

Germany.

Westphalian Series.

Horizon: Seam 7.

Locality: Silesia, Gottesberg. (Pl. 47, fig. 4, 5).

Horizon: ?

Locality: Georg Victor Colliery near Neu-Lässig. (Pl. 45, fig. 3).

Bohemia.

Stephanian Series (Lower part).

Horizon: Kladno-Pilsener Schichten.

Locality: Nyran. (RYBA, 1904, Figure very bad, species right!; Historisches Museum, Pilsen).

Westphalian Series.

Localities: Wranowitz. (Pl. 43, fig. 4).

Bras. (Pl. 40, fig. 4).

CALAMITES VAGINATUS ZEILLER sp.

Pl. 48, fig. 3; Pl. 52, fig. 8.

1899 *Calamophyllites vaginatus* ZEILLER, Héraclée, Mém. Soc. géol. de France, Paléontologie, No. 21, p. 62, Pl. 5, fig. 13.

DESCRIPTION.

Stem measuring 3,5 cm. or more broad. Internodes varying in length from 2 to 5,5 cm. (as observed at present). Outer surface smooth with very fine longitudinal striations and occasionally transverse wrinklins. Branch scars rather over 1 cm. wide, subcircular, approximate or separated by a short distance, placed at the upper end of the internode, with upper margin somewhat flattened against the nodal line. Umbilicus slightly eccentric. Leaf scars subquadrate, approximate, 5 in one centimetre. Leaves setaceous, free, 1,5 to 2 cm. long, single nerved.

REMARKS.

The type of this species is refigured on Pl. 48, fig. 3. It shows two internodes of 5,5 cm. and 2,5 cm. in length respectively. Fragments of two subcircular distant branch scars are placed at the top of the upper and longer internode; to the same node are attached several acicular leaves. The cortex is smooth with very fine short longitudinal striations and in addition certain portions of the internode show transverse wrinklins.

The only other specimen of this species known to us is given on Pl. 52, fig. 8. It also shows two perfect internodes and the remains of two incomplete ones. The lowest internode and that which bears the branch scars is 2 cm. long, while the one immediately above it is 3,7 cm. in length. The branch scars are approximate, subcircular, slightly flattened at their upper margin against the node and 1,5 cm. broad. Remains of the foliage are seen attached to the three nodes shown on this specimen. The leaves are not so well preserved as on the example figured by ZEILLER, but as on

both of the specimens the foliage extends upwards from the node immediately above the branch scars, it is evident, that these latter occur at the top of the internode and not at the base, as in many other species.

ZEILLER describes the leaves as being united to each other in their lower portion, but an examination of the type specimen has led us to believe that they are free.

The quadrate, closely placed leaf scars which are well seen on the specimen given on Pl. 52, fig. 8 distinguish *C. vaginatus* from all the other members of the Genus known to us.

DISTRIBUTION.

Westphalian Series.

Asia Minor.

Horizon: Faisceau des couches 1 à 14.

Locality: Basin of Héraclée, Coslou. (Pl. 48, fig. 3). The horizon of this locality corresponds with the Fettkohlen of the Rheno-Westfalian Coalfield. (cf. ZEILLER, l. c., p. 85; École supér. des Mines, Paris).

Netherlands.

Horizon: Under Seam IV.

Locality: Wilhelmina Colliery, near Heerlen, Limburg. (Pl. 52, fig. 8).

CALAMITES DICTYODERMA KIDSTON et JONGMANS nov. spec.

Pl. 50, fig. 1, 2.

DESCRIPTION.

Stem large, internodes short, 1,6 to 2 cm. long. Cortex smooth, ornamented with a fine and distinct reticulate marking. Leaf scars transversely elongated with a small central point and connected by a striated band. Branch scars verticillate, irregularly placed, transversely oval with lower margin slightly flattened against the nodal line and a large eccentric umbilicus, clearly defined by a surrounding furrow.

Pith cast and foliage unknown.

REMARKS.

The only specimen of this species known to us is that shown on Pl. 50, fig. 1, of which a portion is enlarged on the same plate at fig. 2.

The reticulate cortex, taken in connection with the form of the branch scars, at once distinguishes this species from any other with which we are acquainted.

DISTRIBUTION.

Great Britain.

Westphalian Series.

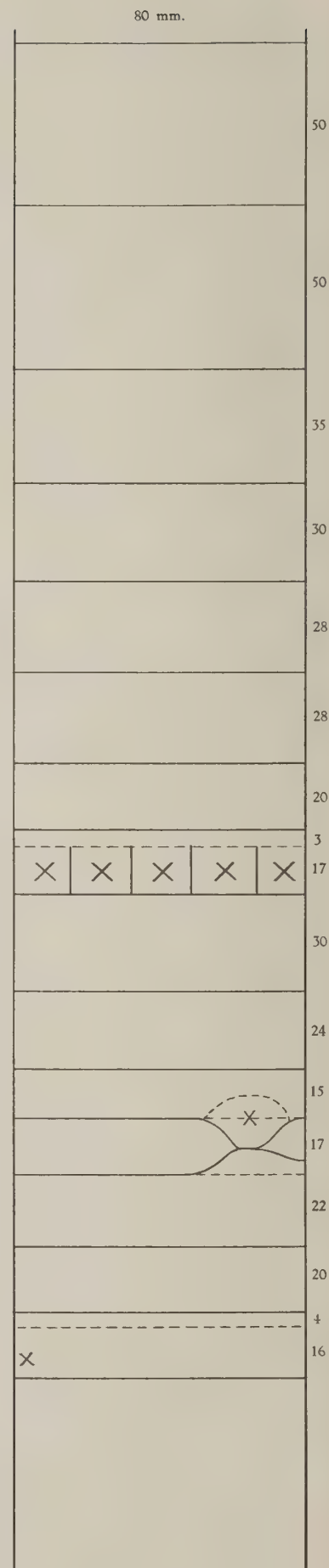
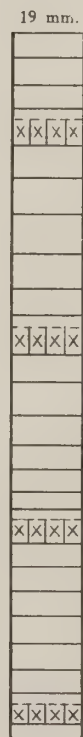
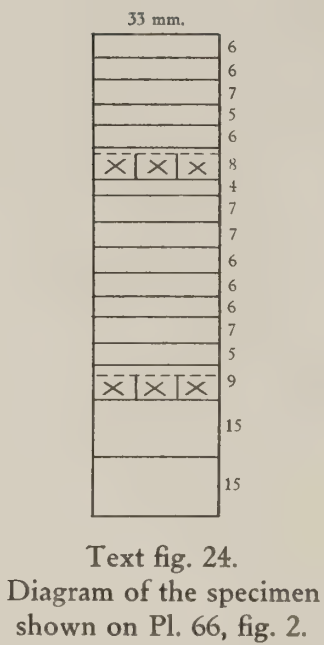
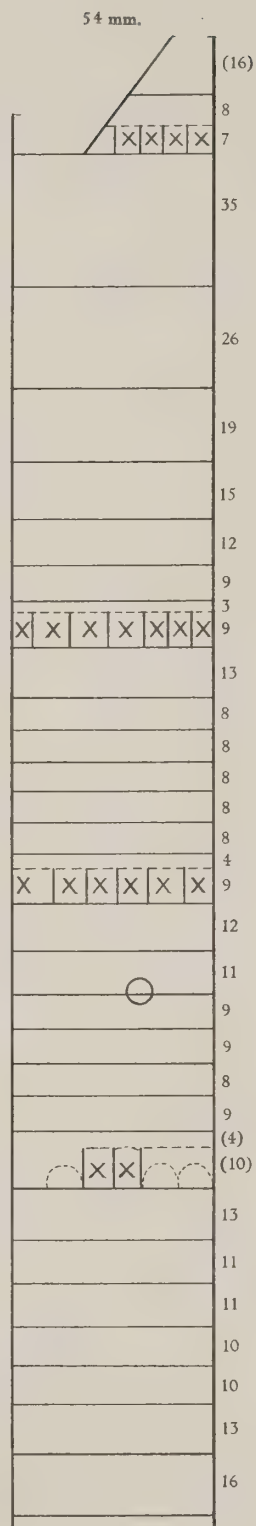
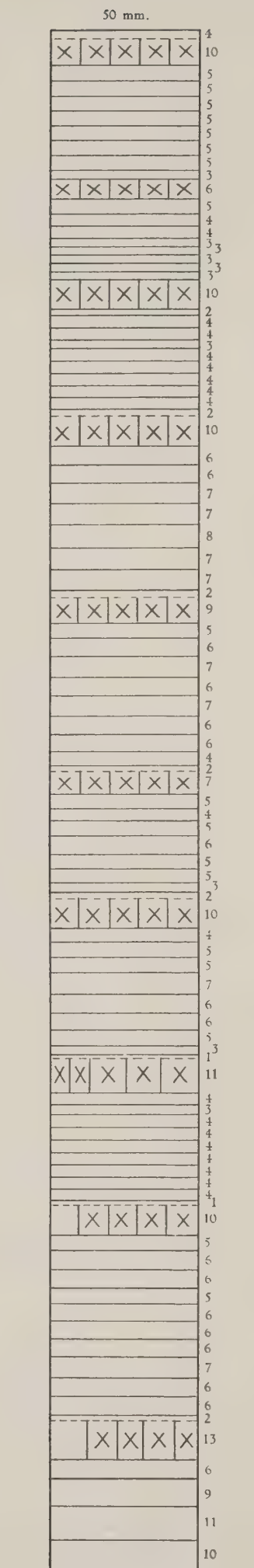
Horizon: Below Black Bed Coal.

Locality: Dolly Lane, Leeds, Yorkshire. Collected by Mr. J. W. BOND. (Collection KIDSTON, No. 2696.)

CALAMITES GOEPPERTI ETT.

Pl. 51, fig. 3, 4; Pl. 53, 54; Pl. 55, fig. 1—4; Pl. 56, fig. 1—4; Pl. 61, fig. 3; Pl. 65, fig. 1; Pl. 66, fig. 1, 2, 3; Pl. 81, fig. 4; Pl. 135, fig. 1, 2; Pl. 136, fig. 1; Text fig. 21—26.

- 1854 *Calamites goepperti* ETTINGSHAUSEN, Radnitz, Abh. k. k. geol. Reichsanstalt, Wien, II, Abt. III, 3, p. 27, Pl. 1, fig. 3, 4.
- 1898 *Calamites goepperti* SEWARD, Fossil Plants, I, pp. 368, 372, fig. 99.
- 1911 *Calamites goepperti* JONGMANS, (pars), Anleitung, I, p. 82, fig. 81, 82, (non fig. 84, 86).
- 1911 *Calamites goepperti* KIDSTON, Hainaut, Mém. Mus. Roy. d'hist. nat. de Belgique, IV, p. 104.
- 1912 *Calamites goepperti* VERNON, Q. J. G. S. London, LXVIII, 1912, p. 622, Pl. 57, fig. 10.
- 1913 *Calamites goepperti* JONGMANS and KUKUK, Calam. Rhein. Westf. Steink., Mededeel. Rijks Herbarium, Leiden, No. 20, p. 26, Pl. 11, fig. 1—3; Pl. 12, fig. 1—3; Pl. 15, fig. 4.
- 1876 *Calamitina goepperti* WEISS, Steink. Calamarien, I, p. 127, Pl. 17, fig. 1, 2.
- 1890 *Calamitina goepperti* KIDSTON, Trans. Yorksh. Nat. Union, XIV, p. 16.
- 1901 *Calamitina goepperti* KIDSTON, Proc. Yorksh. Geolog. and Polyt. Soc., XIV, p. 223, Pl. 34, fig. 1.
- 1887 *Calamitina* SOLMS LAUBACH, Einleitung, p. 326, fig. 42.
- 1869 *Calamophyllites goepperti* GRAND' EURY, Compt. Rend. Ac. des Scienc., Paris, LXVIII, p. 709.
- 1886 *Calamophyllites goepperti* ZEILLER, Valenciennes, Pl. 57, fig. 1; Text, 1888, p. 363.
- 1900 *Calamophyllites goepperti* ZEILLER, Éléments, p. 158, fig. 111.
- 1874 *Cyclocladia major* FEISTMANTEL, Böhmen, p. 96, Pl. 1, fig. 8.
- 1876 *Calamitina solmsi* WEISS, (pars), Steink. Calamarien, I, p. 129, Pl. 18, fig. 1, (non cones); id. II, 1884, p. 74.
- 1884 *Calamites varians abbreviatus* WEISS, Steink. Calamarien, II, pp. 62, 73, Pl. 16a, fig. 10, 11.
- 1884 *Calamites (Calamitina) varians inconstans* WEISS, Steink. Calamarien, II, pp. 62, 69, Pl. 16a, fig. 7, 8; Pl. 25, fig. 2.
- 1889 *Calamites (Calamitina) varians inconstans* KIDSTON, Ravenhead, Trans. Roy. Soc. Edinburgh, XXXV, p. 398, Pl. 1, fig. 1.
- 1901 *Calamites varians inconstans* KIDSTON, Proc. Yorksh. Geol. and Polyt. Soc., XIV, p. 201, Pl. 34, fig. 1.
- 1890 *Calamophyllites inconstans* GRAND' EURY, Gard, p. 209.
- 1887 *Calamites schumanni* STUR, (pars), Calam. Schatzlarer Schichten, p. 83, Pl. 14b, fig. 2, (non fig. 3).
- 1899 *Calamites varians* HOFMANN and RYBA, (pars), Leitpflanzen, p. 23, Pl. 1, fig. 1, (non fig. 2).



Diagrams of stems of CALAMITES GOEPPERTI ERR.

1910 *Calamites varians* RENIER, Docum. Paléont. terr. houiller, Pl. 45.

1855 *Equisetites infundibuliformis* GEINITZ, (non BGT.), (pars), Sachsen, p. 3, Pl. 10, fig. 5, (non fig. 4, 6, 7, 8).

1869 *Macrostachya infundibuliformis* SCHIMPER, (non BGT.), (pars), Traité, I, Pl. 23, fig. 14, (non fig. 13).

DESCRIPTION.

Stem large, attaining a width of 8 cm. Internodes broader than long, very rarely as long as broad or longer than broad. Surface smooth, or finely striated longitudinally, with frequently longitudinal clefts and occasionally showing indication of the ribbing of the internal cast. Branch scars circular, oblong or subquadrate, with a central umbilicus, placed close together and often deformed from mutual pressure. Verticils of branch scars separated by a period of non-branch bearing internodes. The number of internodes in the period varies on different specimens and even on the same stem. Shortest internode usually that immediately above the branch bearing internode, beyond which they gradually increase in length as traced upwards, the last one in the period being frequently the longest. In other cases the internodes are of almost equal length and the internode below the branch scars may be a short one. Leaf scars transversely oval or subquadrate, catenulate with a central cicatrice, touching each other laterally by their flattened sides. Leaves setaceous, free, single nerved and about 2,5 cm. long.

Pith cast not known with certainty.

REMARKS.

This well defined species is represented on the plates by a number of specimens of which those seen on Pl. 53 are perhaps the most generally characteristic. Fig. 1, 2, Pl. 53 show the two halves of the same specimen, fig. 1 fitting on to the top of fig. 2. This fossil shows ten branch verticils, separated by periods of from 7 to 10 branchless internodes. It is represented in Text fig. 21 where at a glance these variations can be clearly observed. Variation in the form and size of the branch scars not only takes place in different whorls, but among the members of the same whorl and is well illustrated on this example, as is also the varying position of the umbilicus in the scars.

It is scarcely necessary to particularise the individual whorls in which these differences occur, but quadrate, circular and transversely elongated scars are found mixed together.

The smooth surface of the internodes with their little irregular clefts is well seen on several parts of the specimen and the subquadrate, approximate leaf scars, occurring at all the nodes, are especially distinct at the upper and lower ends of that part of the stem shown at fig. 1.

The specimen given at fig. 3 of the same plate shows three whorls of branch scars, which are, mostly through mutual pressure, longer than broad and subquadrate in form. The leaf scars are particularly large on this example.

On Pl. 54, fig. 2, 3 the counterpart of the original of *C. varians inconstans* of WEISS

(Pl. 25, fig. 2, Steink. Calam., II) is figured. Fig. 2 fits on to the top of fig. 3. This specimen is remarkable for the variation in the length of the internodes of the various periods. Those on the uppermost period are much longer than those occurring in the periods towards the base of the stem. This can be clearly seen in our Text fig. 22. In addition to the branch scars, on the second internode from the top of the last complete period (fig. 3), a stem springs from the point indicated by a circle on the diagram. The stem is seen on the back of the specimen joining on to the scar which is represented by the circle. The stem itself is given at fig. 1, Pl. 55. This stem scar is not so well seen on our figure as on the other half of the specimen published by WEISS and represented in our Text fig. 23.¹⁾

The scar seen on the second internode from the top in the figure published by WEISS does not occur on the original as represented by him but may be merely an accidental depression on the fossil. This interpretation is borne out by the fact, that on the impression, leaf scars at the corresponding part of the node are not interfered with, but are particularly well shown at this point in our fig. 2, at the left hand side of the first complete internode.

On the lowest verticil of fig. 3, all the scars here, except one, seem to be abortive and the one which is fully developed, from the absence of lateral pressure has a circular form.

A considerable variation in the form of the leaf scars can be observed in this example. Those on the uppermost complete node of fig. 2 are transversely oval, while those at the top of fig. 3 are quadrate.

On Pl. 55, fig. 3 is a fragment which does not show a complete period. The branch scars are slightly elongated and the largest is 1,5 cm. wide and about 2 cm. long. In this example the ribbing of the internal cast is clearly indicated and it seems to show a considerable irregularity in the behaviour of the ribs at the nodes.

The original specimen of *Calamitina goepperti* WEISS is reproduced on Pl. 54, fig. 1. One complete period and two whorls of branch scars are



Fig. 23.

Reduced copy of the original figure of *C. varians inconstans* WEISS.

¹⁾ The figure of WEISS shows 5 complete periods, while on our figure only three are represented. The stem scar mentioned above occurs on the second internode from the top of the third complete period in Text fig. 23.

shown. In the uppermost branch whorl, only four scars are preserved which vary greatly in size, the largest being 1,9 cm. long while the smallest is only 1,4 cm. long. The quadrate leaf scars and the cortex with its fine longitudinal striation and irregular clefts are very distinctly shown.

An example with the circular or subquadrate branch scars is given on Pl. 55, fig. 4. These show the central umbilicus surrounded by an outer circle with faint, radiating striations. The surface of the internodes is smooth and indicates faintly the internal ribbing of the cast.

A specimen with internodes of almost equal length, but longer than usually seen in this species is illustrated on Pl. 61, fig. 3. The scars forming the single whorl present on this specimen also vary considerably in size.

Another example with somewhat long smooth internodes, on which the impression of the ribbing is also seen, is given at fig. 1, Pl. 56. The subquadrate leaf scars and branch scars of varying form characteristic of this species, are well seen on this specimen.

Fig. 2, 3 of the same plate represent the form of the plant with short internodes while that at fig. 3 shows the internodes much furrowed by longitudinal cracks.

On Pl. 66, fig. 1 a specimen with two branch whorls and one complete period is given. The internodes increase gradually in length as traced from the base of the period to its upper end. Through the pressure of the lower whorl of the branch scars on the node the band of leaf scars takes a sinuous course and follows the contour of the lower margin of the branch scars.

On the second last node from the base a single branch scar is situated above and resting on the node. It is evidently the missing branch scar of the verticil above, where a branch scar is absent and its place occupied by a band of leaf scars in their normal position.

The branch scars at fig. 2, Pl. 66 are much more transversely elongated than is usually seen in this species. This evidently arises from the fact that only few have been developed in the whorl. The subquadrate leaf scars are well preserved on this example, of which a diagram is represented in Text fig. 24.

Another small specimen with rather elongated branch scars is given on Pl. 66, fig 3.

Stems of small diameter are seen on Pl. 51, fig. 3, 4 and Pl. 55, fig. 2. That on Pl. 55, fig. 2 shows three complete periods. The bark is longitudinally striated. Some of the nodes in the two lowest periods show curious oval depressions. These are evidently not an integral part of the plant and may be due to fungal agency. A diagram illustrating the distribution of the branch scars and the variation in length of the internodes is seen in Text fig. 25.

Another fragment of a young stem is given on Pl. 51, fig. 4. Only one branch whorl is seen which on the exposed surface exhibits three branch scars. The counterpart of the same fossil is given at fig. 3 and shows the small subquadrate leaf scars and finely striated cortex. In this example the internodes are all of almost equal length.

An illustration of a specimen is seen on Pl. 136, fig. 1 which has unusually long

internodes of almost equal length with exception of that on which the branch whorl is placed. The branch verticil only contains three subcircular scars which are separated from each other by a slight interval. The outer surface of the stem is striated longitudinally and has numerous clefts in the bark.

A fine specimen is represented rather more than half natural size on Pl. 135, fig. 1 and a portion is given natural size at fig. 2 of the same plate. This latter shows the irregularity in the form of the branch scars and some variation in the shape of the leaf scars. On the node at the top of fig. 2 they are more distant than usual in this species but towards the centre of the figure they assume a normal subquadrate form. The most interesting point on this fossil is however the occurrence of a large scar on the fourth internode above that bearing the lowest whorl of branch scars. This extends over the internode immediately below it, carrying down with it the band of leaf scars. These are joined by the band of leaf scars on the node immediately below which bends up to meet it.

Some of the internodes in this specimen attain a greater length than usually seen in this species. This example is illustrated in our Text fig. 26.

Two specimens showing the foliage of *C. goepperti* are given on Pl. 56, fig. 4 and Pl. 65, fig. 1.

That shown at fig. 4, Pl. 56 is the original of *Calamitina goepperti* WEISS, Pl. 17, fig. 1. Here however the foliage is so badly preserved and distorted that it affords little information as to its form and structure.

It is better seen on the figure given on Pl. 65, fig. 1, where a few of the leaves stand out from the right margin of the specimen. They are lanceolate setaceous, about 2,5 cm. long and single veined. This example also shows two branch whorls with subquadrate scars which are separated by very short internodes.

Of the pith cast of *Calamites goepperti* at present we have no certain knowledge as none of the specimens showing the outer surface as far as known to us, has exhibited the pith cast in connection with the cortex. We are however strongly of opinion, that the pith cast of this species is included among those classed under the name of *C. schützeiformis waldenburgensis*.

We have failed to discover any characters by which the following can be separated from *Calamites goepperti* and therefore unite them with that species: *Cyclocladia major* FEISTMANTEL (Pl. 1, fig. 8), *Calamitina solmsi* WEISS (*pars*), *Calamites varians abbreviatus* and *inconstans* as figured by WEISS and KIDSTON, *Calamites varians* HOFMANN and RYBA (Pl. 1, fig. 1) and *C. varians* RENIER.

We also unite with *C. goepperti*, fig. 2, Pl. 14b of *C. schumanni* STUR as it does not show a single character by which it can be separated from *C. goepperti*. The other figure of this species given by STUR we believe to be quite indeterminable.

Of the figures published by GEINITZ under the name of *Equisetites infundibuliformis*, his fig. 4 is *Calamites brittsii* WHITE and fig. 5 is *Calamites goepperti*. His fig. 6 may be *Macrostachya infundibuliformis* to which also according to the original specimen,

his fig. 7 belongs. His fig. 8 is now known as *Equisetites rugosus* SCHIMPER (Traité, I, 1869, Pl. 17, fig. 2).

As *Macrostachya infundibuliformis* SCHIMPER (Pl. 23, fig. 14) is a copy of the upper part of figure 4 of GEINITZ, it must also be united with *C. goepperti* ETT.

There seems to be no reason for concluding that the pith cast given by WEISS under the name of *Calamites varians* cf. *inconstans* (Steink. Calamarien, II, p. 79, Pl. 28, fig. 4) belongs to *Calamites goepperti* ETT. Such pith casts as these we think it much better to place provisionally under the name of *C. schützeiformis* which we believe includes the pith casts of many species that at present we are unable to separate.

Calamites goepperti is distinguished from *C. sachsei* by its more circular and irregular branch scars and by the usually much shorter internodes.

In *C. sachsei* on the other hand the branch scars are smaller, of equal size, quadrate by mutual pressure and the whorl is limited, both above and below by a straight line.

DISTRIBUTION.

Great Britain.

Westphalian Series.

Horizon: Thick Coal.

Locality: Griff Clay Pit, Chilvers Coton, Nuneaton, Warwickshire. (VERNON, pp. 616, 622, Pl. 57, fig. 10).

Horizon: Ryder Coal.

Locality: Arley Colliery, Arley, Warwickshire. (VERNON, p. 618).

Horizon: Below 7 Feet Coal.

Locality: Peel Colliery, Warwickshire. (VERNON, p. 618).

Horizon: Waterloo Coal.

Locality: Meadow Lane Clay Pit, Alfreton, North Derbyshire. (Coll. Dr. L. MOYSEY).

Horizon: 261 yds. below Top Hard Coal.

Locality: Summit Colliery, Kirkby in Ashfield, Nottinghamshire. (Coll. Dr. L. MOYSEY).

Horizon: Between Ell and Deep Soft Coals.

Locality: Newthorp Clay Pit, near Eastwood, Nottinghamshire. (Coll. Dr. L. MOYSEY).

Horizon: ?

Locality: Land's Pit, near Etherley, County of Durham. (Pl. 56, fig. 3) (Coll. Hancock Museum, Newcastle-on-Tyne).

Horizon: Ravenhead Coal.

Locality: Ravenhead, St. Helens. (Liverpool Museum).

Horizon: Barnsley Thick Coal.

Locality: East Gawber Colliery near Barnsley. (Collected by W. HEMINGWAY). (Coll. KIDSTON, No. 1189 and 1190).

Horizon: Barnsley Thick Coal.

Locality: Woolley Colliery, Darton near Barnsley. (Collected by W. HEMINGWAY).
(Pl. 56, fig. 2).

Horizon: Barnsley Thick Coal.

Locality: Monckton Main Colliery near Barnsley. (Collected by W. HEMINGWAY).
(Coll. KIDSTON, No. 2378).

Horizon: 339 yards above Barnsley Coal.

Locality: Maltby Bore, Maltby Colliery near Doncaster. (Pl. 56, fig. 1). (Collected by
W. H. DYSON).

Netherlands.

Westphalian Series.

Equivalent of the Lower "Gaskohle" or Upper "Fettkohle" of the Rheno-Westfalian Coalfield.

Horizon: Shales under Seam II, at 253 m.

Locality: Hendrik Colliery, Brunssum, Limburg, Pit I. (Pl. 135, fig. 1, 2).

Equivalent of the Lower "Fettkohle" of the Rheno-Westfalian Coalfield.

Horizon: Seam II.

Locality: Emma Colliery, near Heerlen, Limburg. (Pl. 136, fig. 1).

Horizon: Seam V.

Locality: Wilhelmina Colliery, near Heerlen. (Pl. 61, fig. 1—3).

Horizon: Seam VIII.

Locality: Laura en Vereeniging Colliery, near Heerlen. (Pl. 55, fig. 2).

Horizon: Seam V.

Locality: Oranje Nassau I Colliery, Heerlen.

Belgium.

Westphalian Series.

Horizon: Seam Masse.

Locality: United Collieries of Charleroi, Pit No. 2 (Sacré Français). (Pl. 55, fig. 3; Coll.
RENIER).

Horizons: Seam Gigotte and Seam at 1420 m.

Locality: Mariemont Collieries, Pit Placard. (Coll. DELTENRE, No. 3378, 3380 and
No. 1568).

Horizon: ?

Locality: Grand Hornu. (Collection SCHMITZ, Louvain, No. 7585).

France.

Westphalian Series.

Faisceau gras de Douai.

Horizon: Seam No. 7.

Locality: Aniche, Pit Gayant. (ZEILLER, Valenciennes, p. 366).

Horizon: Seam No. 5.

Locality: L'Escarpelle, Pit No. 4. (ZEILLER, l.c., p. 366).

Faisceau demi-gras.

Horizon: Seam Printanière.

Locality: Saint Saulve, Pit Thiers. (ZEILLER, l.c., Pl. 57, fig. 1).

Series unknown.

Horizon: ?

Locality: St. Étienne. (Coll. GRAND' EURY, Musée d'Hist. nat. Paris, No. 8283).

Stephanian Series.

Horizon: ?

Locality: Collieries of Ahun (Creuse). (Pl. 65, fig. 1; École supér. des Mines, Paris).

Germany.

Westphalian Series.

Rheno=Westfalian Coalfield.

Gasflammkohle.

Horizon: Seam Bismarck.

Locality: Colliery Graf Bismarck I/IV. (Pl. 53, fig. 1, 2).

Gaskohle.

Horizon: Seam F.

Locality: Colliery Prosper II. (Pl. 56, fig. 2, 3).

Horizon: Seam II.

Locality: Colliery Mont Cenis. (Pl. 53, fig. 3).

Fettkohle.

Horizon: Seam 5.

Locality: Colliery Kaiserstuhl (Westfalia). (Coll. Berggewerkschaftskasse, Bochum).

Horizon: ?

Localities: Colliery Glückauf-Tiefbau near Dortmund. (Pl. 66, fig. 1).

Colliery Heinrich Gustav near Werne. (Original WEISS, II, Pl. 16a, fig. 10, 11).

Silesian Coalfield.

Horizon: Schatzlarer Schichten.

Locality: Ruben-Colliery near Neurode. (*C. schumanni* STUR, 1887, Pl. 14b, fig. 2).

Horizon: Niederschlesischer Hangendzug.

Locality: Wrangel-Pit, Glückhelf-Colliery near Hermesdorf. (Collection Geol. Landesanstalt, Berlin).

Horizon: Schatzlarer Schichten.

Locality: Gottesberg, Mayraun-Pit, Seam 13. (Pl. 54, fig. 2, 3; Pl. 55, fig. 1).

Bohemia.

Westphalian Series.

Horizon: ?

Localities: Radnitz. (Pl. 54, fig. 1; Pl. 55, fig. 4; Pl. 56, fig. 4).

Rakonitz. (Zwinger Museum, Dresden).

CALAMITES SACHSEI STUR.

Pl. 56, fig. 5, 6?; Pl. 57, fig. 1—3?, fig. 4—7; Pl. 58, fig. 1, 3; Pl. 59, fig. 1; Pl. 60, fig. 1, 2, 3; Pl. 61, fig. 1, 2; Pl. 62, fig. 1, 2; Pl. 63, fig. 4, 5, 6; Pl. 66, fig. 4; Pl. 95, fig. 1; Pl. 99, fig. 2.

Text fig. 27—39.

1878 *Calamites sachsei* STUR, Verhandl. k.k. Geol. Reichsanstalt, Wien, p. 327.

1887 *Calamites sachsei* STUR, (*pars*), Calam. schatzl. Schichten, p. 180, Pl. 2, fig. 1, 3, 4, 5; Pl. 2b, fig. 2; Pl. 5, fig. 1; Pl. 11, fig. 1. (*ref. in part*).

1888 *Calamites sachsei* TOULA, (*pars*), Die Steinkohlen, p. 205, Pl. 5, fig. 23, (*non* fig. 22, *non* Pl. 6, fig. 2).

1911 *Calamites sachsei* JONGMANS, Anleitung, I, p. 89, fig. 85, 87, 88.

1911 *Calamites sachsei* KIDSTON, Hainaut, Mém. Mus. Roy. Hist. nat. de Belgique, IV, p. 101, Pl. 12, fig. 1, 2; Pl. 13, fig. 1.

1913 *Calamites sachsei* JONGMANS and KUKUK, Calamarien Rhein. Westf. Kohlenb., Mededeel. Rijks Herbarium, No. 20, p. 29, Pl. 12, fig. 4.

1884 *Calamites varians sachsei* WEISS, Steink. Calamarien, II, p. 77.

1884 *Calamites (Calamitina) extensus* WEISS, Steink. Calamarien, II, p. 87, Pl. 4, fig. 2.

1911 *Calamites extensus* JONGMANS, Anleitung, I, p. 91, fig. 89.

1887 *Calamites schatzlarensis* STUR, (*pars*), Calam. schatzl. Schichten, p. 164, Pl. 13, fig. 10, 11.

1910 *Calamites species* STOPES, Ancient Plants, p. 147, fig. 104.

- 1911 *Calamites varians insignis* JONGMANS, (non WEISS), (pars), Anleitung, I, p. 76, fig. 75.
 1912 ? *Calamites varians insignis* JOHNSTONE, Memoirs and Proceed. Manchester Lit. and Phil. Soc., LVI, No. 17, Plate.
 1911 *Calamites varians* cf. var. *inversus* JONGMANS, Anleitung, I, p. 86, fig. 83.
 1911 *Calamites goepperti* JONGMANS, (non ETT.), (pars), Anleitung, I, p. 82, fig. 84, 86.

FRUCTIFICATION:

Palaeostachya ettingshauseni KIDSTON.

DESCRIPTION.

Stems, as far as known varying from 2 to 15 cm. in diameter. Internodes broader than long, rarely and apparently only on young specimens longer than broad. Outer surface of cortex smooth with very fine fibrillous striations, occasionally fissured longitudinally or wrinkled transversely. Branch whorls borne periodically and separated from each other by 3 (rarely 1) to 10 or more internodes. Branch scars small, attaining a diameter of 1,1 cm. and a height of 9 mm., subquadrate or quadrate through mutual pressure, broader than long or longer than broad. Generally the various scars in a whorl are of equal height and limited above and below by a straight or slightly flexuous line, having the appearance of a solid band surrounding the stem. Umbilicus central, large and generally surrounded by a limiting circle. The umbilicus is frequently marked by radiating lines but the surrounding circle is smooth. Leaf scars transversely elongate, subcatenulate, more usually quadrate through mutual pressure.

Cones borne on lateral branches, 4 or more cm. long, whose short pedicils have a bulbous base where they join the stem.

Each of the nodes of the fertile branches bears a whorl of four cones (*Palaeostachya ettingshauseni* KIDSTON).

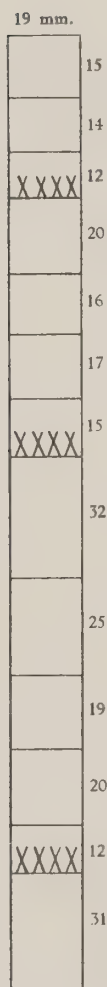
Foliage unknown.

Pith cast.

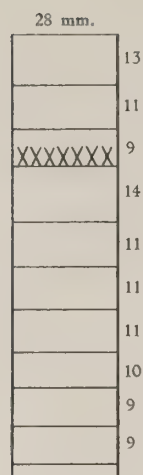
Internodes with straight margins not contracted at the nodal line. Ribs separated by wide furrows, narrow with small elongated terminal tubercles at their upper ends. Surface longitudinally striated, not terminating in sharp points. Branch scar cicatrices small, circular, about 3 mm. in diameter and to which the ribs do not converge. Lateral stems arise very rarely from other stems. Their position is indicated by a large scar having a diameter of about 1 cm., which as far as observed is situated on the first or more rarely on the second node above that bearing the branch whorl.

REMARKS.

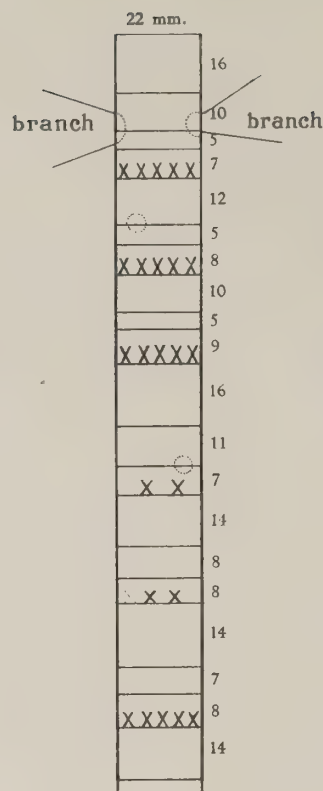
The stem of smallest diameter, with which we have met is shown on Pl. 58, fig. 3. It has three branch whorls, each separated by four internodes, whose outer surface is finely striated longitudinally and bears irregular longitudinal cracks. The shortest internode is in all cases that immediately above a branch whorl and beyond this point they



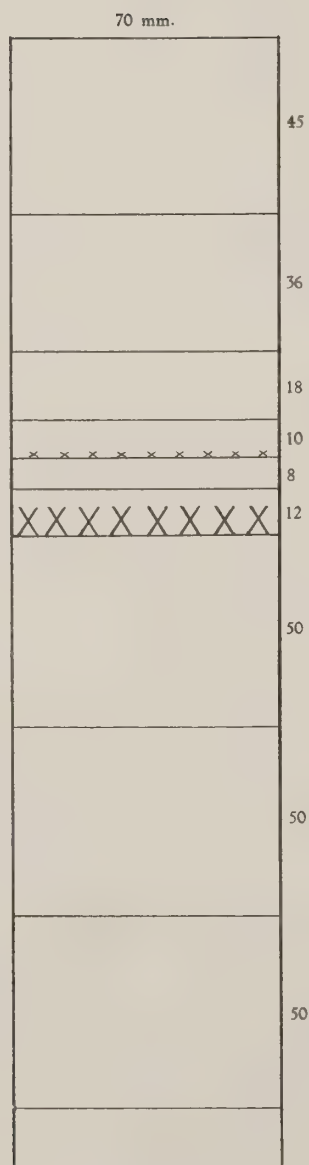
Text fig. 27.
Diagram of the specimen
shown on Pl. 58, fig. 3.



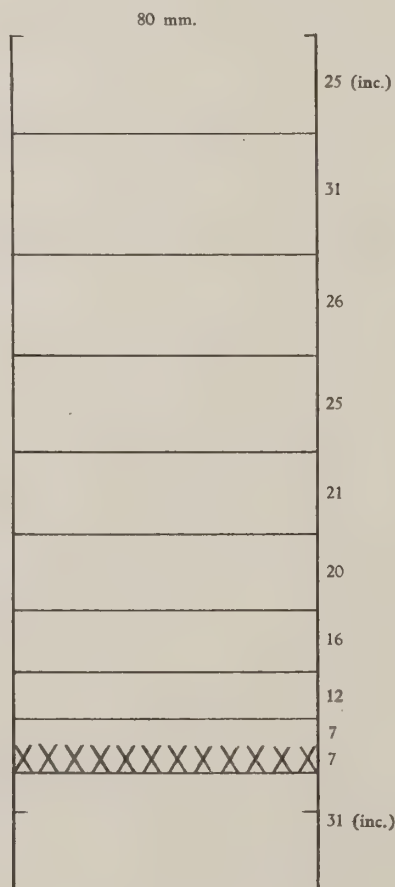
Text fig. 29.
Diagram of the specimen
shown on Pl. 57, fig. 5.



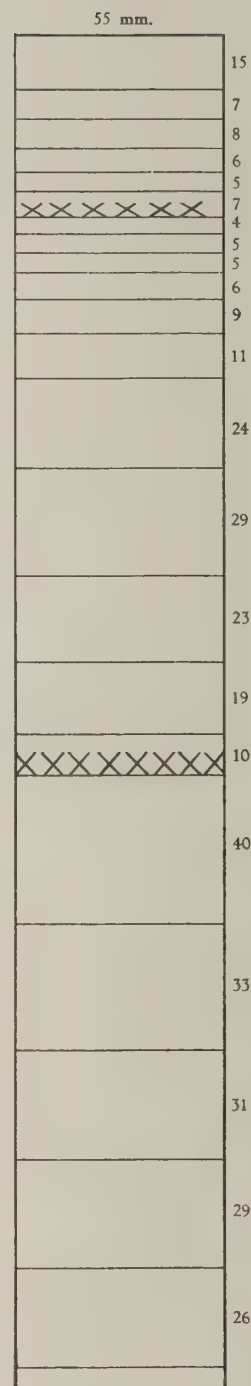
Text fig. 28.
Diagram of the specimen
shown on STUR's Pl. 5, fig. 1.



Text fig. 30.
Diagram of the specimen
shown on Pl. 58, fig. 1.



Text fig. 31.
Diagram of the specimen
shown on Pl. 61, fig. 1, 2.



Text fig. 32.
Diagram of the specimen
shown on Pl. 60, fig. 2, 3.

generally increase in length, the longest being below the next occurring branch whorl. The branch scars are quadrate, somewhat longer than broad, closely pressed together and form a continuous band around the stem.

The leaf scars are subquadrate or elongate subquadrate and vary much in form in the same whorl, sometimes being longer than broad, and at other times broader than long. They have a small central cicatrice.

Two small portions of the pith cast still adhere to this impression which shows the ribs to be longitudinally striated and divided by wide shallow furrows.

A diagram of this specimen is given at Text fig. 27.

Another specimen of about the same size is given by STUR on his Pl. 5, fig. 1. This shows the branch whorls to be separated by three internodes. The most interesting point of this specimen however is the attachment of two branches, one at each side of the upper portion of the stem. These appear to arise from the second node above the branch whorl. On the two lateral branches the period separating the branch whorls varies from three to four internodes. In the third period from the base of the figure as also in the fifth period, a single scar is seen on the first or second node over the branch whorls. These may be stem scars from which the stems have fallen, although they appear to be of rather small a size. A diagram of this fossil is seen in Text fig. 28.

Similar specimens are figured by KIDSTON (1911), Pl. 13, fig. 1 and by STUR (1887) on Pl. 11, fig. 1. That on KIDSTON's Pl. 13, fig. 1 also shows a daughter stem attached.

A small fragment showing a whorl of branch scars, the finely striated outer surface, and the leaf scars, is given on Pl. 57, fig. 5. In this little example the closely placed subquadrate scars are very clearly seen. On the second internode below the branch whorl a small oval scar occurs. This is very similar to those described on the specimen of *C. goepperti* given on Pl. 55, fig. 2 and is also probably due to some fungoid agency. A diagram of this fossil is given in Text fig. 29.

On Pl. 57, fig. 4 is figured another specimen showing a single branch whorl. Some of the branch scars here are more rounded on their upper margin than usual in this species but their lower margin is flattened and forms a straight line parallel with the node. The outer surface is finely striated and beneath the nodes are short longitudinal ridges which appear to descend from the leaf scars. On several of the internodes some of the curious fungus-like markings occur as well as transverse wrinklins.

A stem attaining a width of 7,5 cm. is shown on Pl. 58, fig. 1 and a diagram is seen at Text fig. 30. The short internode on which the branch scars are placed is followed by a still shorter one and at the base of another short internode which rests upon it, is a verticil of small circular scars about 1,5 mm. in diameter. These are placed somewhat closer to each other than the branch scars, there being 8 branch scars and 9 of the smaller ones on the exposed surface of the stem. Possibly these latter may be root scars as they are smaller than the branch scars on pith casts of *C. sachsei*. The surface of the bark is very finely striated or even smooth in parts but at several places on the specimen the ribbing of the pith cast with its wide dividing furrows is distinctly seen. The lowest

node shows the leaf scars, which here are transversely oval, while on the upper node they appear to be much closer and more quadrate.

A fragment of a stem with a single verticil is given on Pl. 62, fig. 1, which shows the structure of the individual scars, especially in the left hand part of the whorl. The large umbilicus with the radiating striations is clearly observable. The normally smooth area of the scar immediately above the umbilicus also shows a few radiating bars on some of the scars but these seem to be the result of wrinkling or folding of the tissue. The fine longitudinal striations are very distinct on this example.

Another large stem, the original of STUR's Pl. 2b, fig. 2, which also shows a single verticil of branch scars is given on Pl. 61, fig. 1. The verticil is here very typical and appears as a narrow band with straight margins. Some of the leaf scars of this specimen are enlarged at fig. 2. These are elongated transversely and are connected by their pointed terminations. A diagram of this specimen is seen in Text fig. 31.

Fragments of two large stems preserved in the "HUTTON Collection" are given on Pl. 60, fig. 1 and Pl. 63, fig. 6. The branch scars shown on the specimen given on Pl. 60, fig. 1 are slightly more elongated than usually seen in this species and some of the leaf scars, whose lateral angles somewhat overlap, (a condition occasionally seen in other species), are shown at the node immediately beneath the branch whorl.

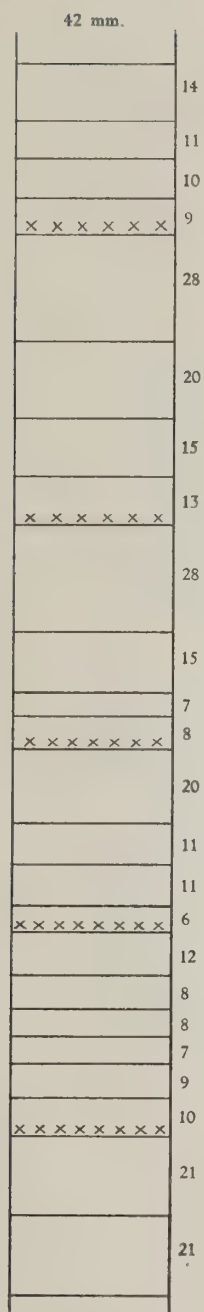
The fossil shown on Pl. 63, fig. 6 represents a fragment of the largest stem we have yet seen. But as it is imperfect on both margins, its full size cannot be ascertained.

Another fragment given on Pl. 66, fig. 4 shows a few very typical subquadrate scars with their large umbilicus. This specimen is interesting because it is the only one yet known to have been discovered in the Rheno-Westfalian Coalfield.

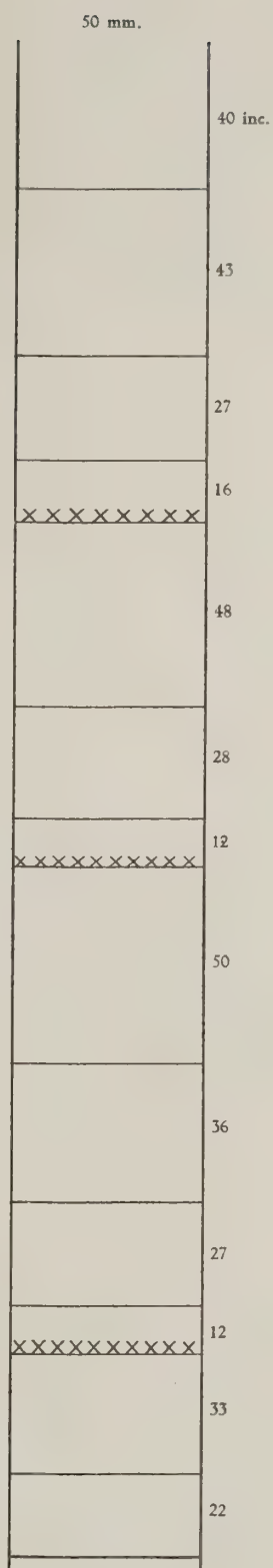
A specimen showing a stem scar is given at fig. 2, Pl. 62. It is circular, 8 mm. in diameter and occurs at the node immediately above the branch scar whorl. Another example showing a still larger branch scar is given on Pl. 57, fig. 6. This scar is about 1 cm. wide and also occurs at the node immediately above the upper branch whorl. Another and apparently similar scar is seen on the node immediately above the lower branch whorl. It may be pointed out, that all the stem scars or stems seen in organic connection with *C. sachsei* occur on the first or more rarely on the second node above the branch whorl.

A stem with an abnormally long internode apparently immediately above the branch scars is given on Pl. 57, fig. 7. Below the branch scars which are normal in form and arrangement, the internode though it is incomplete measures 1,7 cm., so even if the specimen be shown on the plate in inverted position, it has had unusually long internodes associated with the branch whorl.

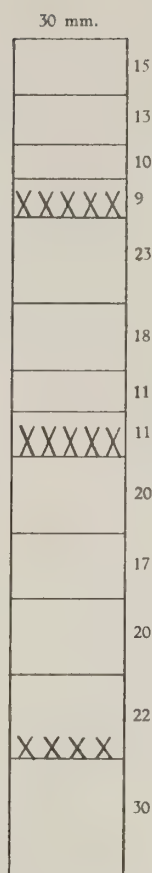
An example showing the pith cast and parts of its surface is given on Pl. 60, fig. 2, 3. The lowest branch whorl of fig. 2 corresponds to the uppermost verticil of scars, seen at fig. 3. At the base of both the figures and at the top of fig. 3 part of the pith cast is seen. The ribs clearly extend past and over the branch scars, to which no convergence takes place. At the lower part of fig. 3 the narrow, oval tubercles are seen on the upper



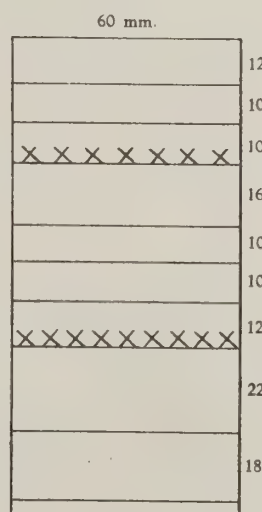
Text fig. 33.
Diagram of the specimen
shown on Pl. 63, fig. 4, 5.



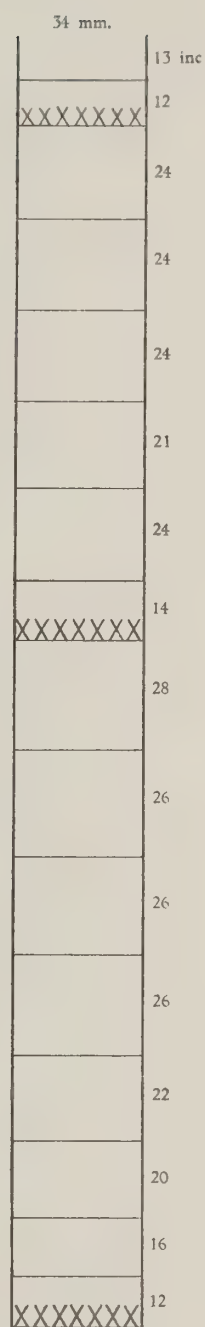
Text fig. 35.
Diagram of the specimen
described on p. 67.



Text fig. 36.
Diagram of the specimen
described on p. 67.



Text fig. 34.
Diagram of the specimen
shown on Pl. 57. fig. 1.



Text fig. 39.
Diagram of the original specimen
of *C. extensus* WEISS (See p. 68).

extremities of the ribs. The top part of fig. 2 shows an abnormality which has probably been caused by a damage to the stem, that has resulted in the reduction of the size of some of the branch scars as well as in the shortening of the internodes both below and above them. A diagram of this specimen is given at Text fig. 32.

Pl. 63, fig. 4, 5, show a pith cast. The part represented at fig. 4 fits on to the top of fig. 5. Five verticils are seen which are represented by small circular scars. Those on the lowest whorl being slightly larger than the others, but this may be the result of indifferent preservation. There is little or no convergence of the ribs towards them. The stem is not contracted at the nodes. The ribs are not very prominent and are divided by relatively wide shallow furrows. At most of the nodes the narrow elongated tubercles can be seen which however seem to have suffered somewhat from crushing. A diagram of this specimen is represented at Text fig. 33.

On Pl. 95, fig. 1 and on Pl. 99, fig. 2, two pith casts of this species are shown both of which exhibit a whorl of branch scars, indicated by their closely placed circular

cicatrices and which are followed by a short internode immediately above them.

The specimen figured as *Calamites varians insignis* by MISS JOHNSTONE (Memoirs and Proc. Manchester Lit. and Phil. Soc., Session 1912, Vol. LVI [1912], No. 17, Plate), is reproduced here on Pl. 57, fig. 1, 2, 3, Pl. 56, fig. 5, 6 and at Text fig. 34. The outer surface is very much decayed and it is therefore difficult to determine the species to which it belongs as the branch scars do not show their original form either on the cortex or on the pith cast, but seem to represent an intermediate condition of preservation. Taking into

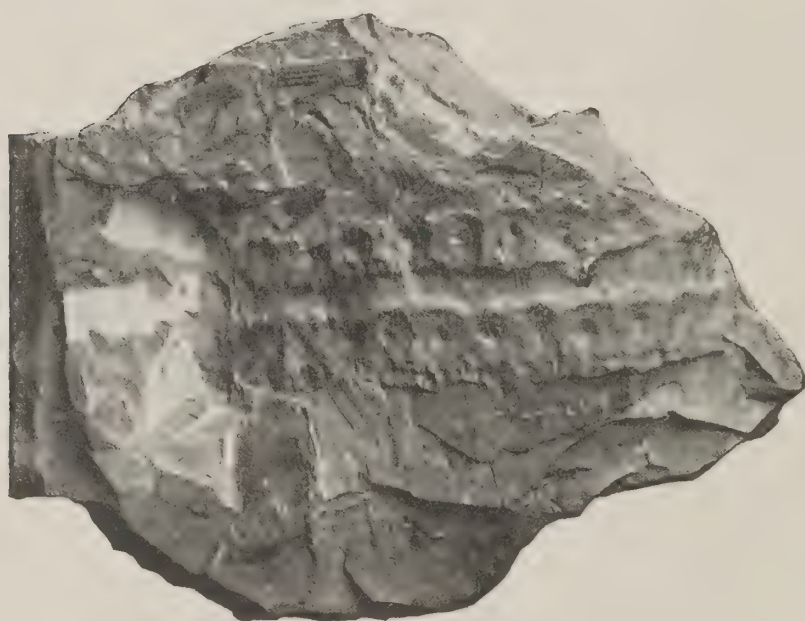


Fig. 37.

C. sachsei STUR, Wilhelmina Colliery, Seam V, Netherlands (described on p. 67).

consideration the whole characters of the specimen, as far as available, it is probably referable to *C. sachsei*. As the scars now appear they certainly want the quadrate form typical of that species. On the other hand although somewhat circular or oval, they are too closely placed and too numerous for those of *C. varians insignis* (= *C. undulatus*), to which it originally has been referred. Judged however by the number of internodes in the period and their relative sizes it agrees perfectly with *Calamites sachsei*. A small fragment of the outer surface was shown at the back of the specimen and this is repre-

sented at fig. 3, Pl. 57, but even here the preservation of the branch scars is unsatisfactory.

On Pl. 56, fig. 5 an enlarged portion of the outer surface of the stem is given. Probably it has here undergone only a slight amount of decay as it still shows the leaf scars. Another portion of the stem from which the epidermal layer has evidently disappeared is given at fig. 6 of the same plate where a distinct close fibrillous longitudinal striation is seen, and at fig. 5, Pl. 57 a still further state of decay of the cortex is observable and which exhibits a number of prominent longitudinal fibres which towards the centre of the figure are seen to unite and form an imperfect mesh. Each of these three figures seems to represent a different cortical layer.

A diagram of a pith cast is shown at Text fig. 35 from a specimen not given on the plates¹⁾. This is chiefly remarkable from the few and long internodes forming the periods, one of which consists of four and the other of three internodes.

Another diagram of a pith cast which further illustrates the variation in the length of the internodes comprising a period is given in Text fig. 36. The lowest period here contains four internodes of almost equal length but the succeeding period is more normal, the internode above the branch whorl being a short one.

All the specimens previously described by us have at least three internodes in the periods which separate the verticils of branch scars, but in a Dutch example from Wilhelmina Colliery, Seam V, two verticils of scars occur separated by a single internode (Text fig. 37). The leaf scars are well seen below the upper verticil, as well as at the upper and lower margins of the second verticil. The upper verticil occurs at the base of an internode, of which a

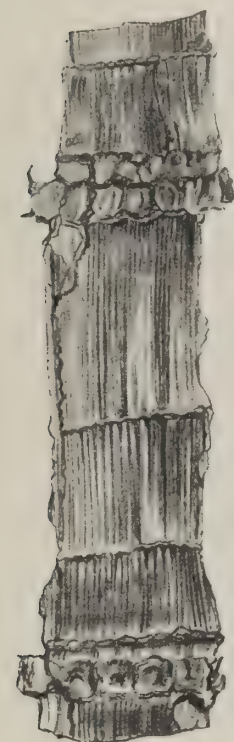


Fig. 38A.

Part of the stem of
C. sachsei, STUR's
Pl. 11, fig. 1.



Fig. 38B.

Reduced copy of STUR's
Pl. 11, fig. 1.

fragment can be seen above the scars but the second verticil occupies the whole of the internode. Apparently below the second verticil is a rather long internode. The branch scars show the characteristic form of those of *C. sachsei*.

A fertile specimen of *C. sachsei* has been given by STUR on his Pl. 11, fig. 1 (repro-

¹⁾ The specimens represented in our text figures 35, 36 were found in Wilhelmina Colliery, Netherlands, Seam VI.

duced in our Text figs. 38 A and B), but here there is no organic connection of the branches with the stem, which lie on a different level in the stone. We however know from the specimen shown on our Pl. 59, fig. 1, that STUR was correct in referring the cones which lie beside his stem, to *C. sachsei*. Our example exhibits the termination of a stem bearing two branches in organic connection, one of which bears an immature cone. Another branch lying parallel with the last, though not organically connected with the stem bears similar cones which are identifiable with those of *Palaeostachya ettingshauseni* KIDSTON. The stem in the lower part of this specimen is mostly represented by the pith cast. The upper end of the fossil is very much crushed. The structure of the cones will be treated of fully in dealing with that section of our subject.

The pith cast also in this specimen, shows the non-contracted nodes characteristic of *C. sachsei*.

We unite with this species *Calamites extensus* of WEISS which is absolutely identical in every respect with *C. sachsei*. It has the quadrate branch scars with the short internode immediately above them and the non-contracted nodes of the pith cast which are characteristic of this species. A diagram of it is given at Text fig. 39. (p. 65).

We also unite with *Calamites sachsei* some of the specimens described by STUR under the name of *C. schatzlarensis* (STUR's Pl. 13, fig. 10, 11). Both of these specimens represent pith casts with a slight film of carbonaceous matter adhering to their surfaces. They are very fragmentary in so far that their margins are very much broken but they show the characteristic periods which separate the verticils, as well as the small approximate branch scars and the elongated tubercles at the upper ends of the ribs which occur on *Calamites sachsei*. Both STUR's figures are given on his plate in inverted position.

STUR has included under the name of *C. sachsei* several specimens, some of which are too imperfectly preserved to admit of any satisfactory specific determination, while others belong to plants which have no connection with it. The specimens which he includes under the name of *C. sachsei* and which we believe to be too imperfect to admit of any specific determination, are his Pl. 2, fig. 2, 9, 10 and (?7). STUR's Pl. 2b, fig. 1 and probably Pl. 3, fig. 1, belong to *C. undulatus*; Pl. 2b, fig. 3 is an *Asterophyllites* of the type of *A. longifolius*; Pl. 2, fig. 6 and ? fig. 8 represent *Palaeostachya gracillima*; Pl. 2, fig. 7 is probably referable to *Palaeostachya ettingshauseni* and if so, the fructification of *C. sachsei*; Pl. 9, fig. 3, Pl. 11, fig. 2, 3, 4, 5, 6 are *Sphenophyllum* species. Text fig. 39 on p. 233 belongs to *Sphenophyllum* cf. *emarginatum*.

The distinctive characters which separate this species from *C. goepperti* have already been mentioned in the remarks under that species.

DISTRIBUTION.

Great Britain.

Westphalian Series.

Horizon: Woolley Edge Rock.

Locality: Oaks Colliery, Barnsley, Yorkshire. Collected by W. HEMINGWAY. (Pl. 58, fig. 3).

Horizon: Bensham Seam.

Locality: Yarrow, County of Durham. (Hancock Museum, Newcastle-on-Tyne. Pl. 60, fig. 1; Pl. 63, fig. 6).

Horizon: Crow Coal.

Locality: Phoenix Brickworks, Crawcrook, Ryton. Collected by W. ELTRINGHAM.

Horizon: Shale immediately below Better Bed Coal, extreme base of Westphalian Series.

Locality: Bradford Brick and Tile Company, Quarry, Seymour Street, Bradford. (Orig. JOHNSTONE, 1912, our Pl. 56, fig. 5, 6; Pl. 57, fig. 1–3).

Lanarkian Series.

Horizon: 15 Feet above the top of the third Millstone Grit.

Locality: Clay Pit, Chilburn, 1³/₄ miles N. N. E. of Littleborough, Lancashire. (Pl. 59, fig. 1; Museum, Victoria University, Manchester).

Horizon: Near base of Coal bearing group.

Locality: Blairpoint, Dysart, Fife. (Collection KIDSTON, No. 4830).

Horizon: Roof of Lower Five Foot Coal.

Locality: Devon Pit at Devon Old Ironworks, 1 m. S.W. of Tillicoultry, Clackmannanshire. (Coll. Geological Survey of Scotland, No. T. 3275^E).

Netherlands.

Westphalian Series.

Equivalent of the Lower "Fettkohle" of the Rheno-Westfalian Coalfield.

Horizons: Seam IV, Seam V, Seam VI.

Locality: Wilhelmina Colliery, near Heerlen, Limburg. (Pl. 57, fig. 4, 7; Pl. 58, fig. 1; Pl. 60, fig. 2, 3; Pl. 63, fig. 4, 5; Text fig. 35, 36).

Horizon: Shales over Seam I.

Locality: Boring Oranje Nassau B, near Heerlen. (Pl. 57, fig. 6).

Horizon: Seam VIII.

Locality: Laura en Vereeniging Colliery, near Heerlen.

Belgium.

Westphalian Series.

Mariemont Collieries.

Horizon: Seam du Parc.

Localities: Pit Réunion. (Pl. 62, fig. 1; Coll. DELTENRE).

Pit St. Arthur. (Coll. DELTENRE, No. 1816).

Pit Placard. (Coll. DELTENRE, No. 1245).

Horizon: Seam Jules.

Locality: Pit St. Eloi. (Pl. 62, fig. 2; Coll. DELTENRE).

Horizon: Seam Olive.

Locality: Pit St. Arthur. (Coll. DELTENRE, No. 3434, 3435).

Horizon: Seam Lahestre.

Locality: Pit Placard. (Coll. DELTENRE, No. 260, 3292).

Horizon: Seam aux Laies.

Locality: Pit Placard. (Coll. DELTENRE, No. 3120).

Collieries of Bois d'Avroy.

Horizon: Seam Houlleux.

Locality: Pit Grand Bac. (No. 68757, Coll. Université, Liège).

France.

Westphalian Series.

Bassin du Nord.

Horizon: Seam No. 7.

Locality: Aniche, Pit Gayant. (Musée houiller de Lille).

Germany.

Westphalian Series.

Rheno-Westfalian Coalfield.

Horizon: Seam A.

Locality: Colliery Recklinghausen. (Pl. 66, fig. 4; Berggewerkschaftskasse, Bochum).

Upper Silesia.

Horizon: Schatzlarer Schichten, (Mulden-Gruppe).

Localities: Orzesche Colliery near Orzesche. (*C. extensus* WEISS).

Orzesche, Roof of Leopold-Seam. (Pl. 61, fig. 1, 2; K. K. Geol. Reichsanstalt, Wien).

Orzesche, Ober-Seam. (*C. schatzlarensis* STUR's Pl. 13, fig. 10, 11).

Horizon: Obere Mulden-Gruppe.

Locality: Boring Ellgoth near Idaweiche, 318 m. (Geol. Landesanstalt, Berlin).

Bohemian-Lower-Silesian Coalfield.

Horizon: Schatzlarer Schichten.

Localities: Julius-Pit of the Fuchs-Colliery. (STUR's Pl. 2, fig. 4).

Wrangel-Pit, Glückhils-Colliery near Hermesdorf. (Pl. 57, fig. 5; Geol. Landesanstalt, Berlin).

Saxony.

Horizon: ?

Locality: Lugau. (Museum Chemnitz).

CALAMITES VERTICILLATUS L. et H.

Pl. 51, fig. 2; Pl. 52, fig. 3—7; Pl. 156, fig. 7.

1835 *Calamites verticillatus* L. et H., Fossil Flora, II, p. 159, Pl. 139.

1884 *Calamites verticillatus* WEISS, Steinkohlen Calamarien, II, p. 85 (171).

1911 *Calamites verticillatus* JONGMANS, Anleitung I, p. 61, fig. 67, (non fig. 68).

1890 *Calamitina verticillata* KIDSTON, Trans. Yorksh. Nat. Union, Pt. XIV, p. 17.

1893 *Calamitina verticillata* KIDSTON, Kilmarnock, Trans. Roy. Soc. Edinburgh, XXXVII, p. 311, Pl. 4, fig. 18.

1893 *Calamites goepperti* KIDSTON (non ETT.), Kilmarnock, Trans. Roy. Soc. Edinburgh, XXXVII, Pt. II, p. 310.

DESCRIPTION:

Stem attaining a width of 5,5 cm. or more. Internodes varying in length from 0,75 to 7 cm. or more. The shortest internode generally lies immediately above that bearing the branch scars. Surface of cortex smooth with fine longitudinal striations, through which very frequently the ribbing of the pith cast is more or less distinctly seen. Branch scars large, attaining a height of 1,75 cm. or more, approximate, subquadrate, with straight sides and slightly convex upper and lower margins. Umbilicus usually more or less eccentric, occasionally central. Leaf scars transversely elongate, with a small central cicatrice, united laterally by their prolonged margins.

Pith cast unknown.

REMARKS.

On Pl. 52, fig. 7 is shown a fragment of a small stem of *Calamites verticillatus*. The branches are borne periodically and at the base of the figure a verticil of branch scars is seen, which individually are placed so close together that their sides become flattened from mutual pressure, though their upper and lower margins generally retain a slight convexity but in some cases the upper margin is almost flat. The umbilicus is subcentral in this specimen. The nodes above that which bears the branch scars are here of almost equal length, but only three are preserved. No example has yet been found which shows the number of internodes that separate the branch whorls from each other.

Another small specimen is given at fig. 4, Pl. 52. This shows the upper margin of the branch scars to be almost straight, though the lower margin is convex. These characters are better seen in the enlargement given at fig. 5, where the branch scars show a very eccentric umbilicus. The internode immediately above that which bears the branch scars is unusually short and shows at its base a chain of leaf scars. These are distinctly seen on the enlargement given at fig. 5. They are transversely oval with elongated points by which they are united to each other. The bark on this example is quite smooth with the exception of a few longitudinal striæ.

Another example is given at fig. 3, Pl. 52, where the branch scars are longer than broad and very much flattened by mutual pressure, but their general form is very similar to those already described. Above the branch bearing internode eight other internodes are seen, the lower of which is very short but as traced upwards they gradually increase in length. The internode immediately below that which bears the branch scars is long.

At fig. 6, Pl. 52, a small fragment is illustrated to show the elongate-quadrate form of the branch scars with their eccentric umbilicus placed towards their base. The cortex is distinctly striated longitudinally.

Another small specimen is seen on Pl. 51, fig. 2. This is not well preserved but shows quite clearly the quadrate scars closely placed together and a coarse longitudinal striation of the stem.

Perhaps the most perfect specimen we have yet met with is that given on Pl. 156, fig. 7. Two central perfect and two lateral incomplete branch scars are seen, which possess the characteristic straight sides, with, in this case slightly convex upper and lower margins. The umbilicus here is more central than usual. The outer surface of the specimen is very distinctly longitudinally striated and probably represents a subepidermal condition of the plant.

The specimen figured as *C. verticillatus* by ZEILLER (Valenciennes, p. 360, Pl. 57, fig. 2) is reproduced on our Pl. 52, fig. 1. The branch scars are badly preserved but they are more circular than those of *C. verticillatus* and only occupy a small portion of the internode. The specimen cannot be referred to *C. verticillatus* L. et H. and might be a badly preserved example of *C. semicircularis* (cf. Pl. 45, fig. 1, 2. The specimen given at fig. 2 has been figured as *verticillatus* by KIDSTON in Proc. Yorksh. Geol. and Polyt. Soc., XIV, p. 200, Pl. 36, fig. 4). If this supposition be correct, than the specimen is placed on our plate in inverted position. Two leaf scars of this example are shown enlarged at fig. 2.

C. verticillatus of ETtingshausen (Haidinger's Naturw. Abh., IV, I, p. 68, 75, Pl. 8, fig. 1; our text fig. 40) with its verticils of small circular scars borne at every node is essentially distinct from *C. verticillatus* of L. et H. The specimen which is very badly preserved, is in the collection of the Hofmuseum, Vienna. It has been referred to *C. cruciatus ettingshauseni* by STERZEL (Rothlieg. im Plauenschen Grunde, Abh. math. phys. Classe der k. Sächs. Ges. d. Wiss., XIX, 1893, pp. 59, 81) but although satisfied that it does not belong to *C. cruciatus* we do not feel justified in proposing any specific position for this example.

WILLIAMSON (On the Organization, V, Phil. Trans. Roy. Soc. London, CLXIV, 1874, pp. 66, 67, Pl. 7, fig. 45) under the name of *C. verticillatus* gives a reduced figure of a fine specimen of *Calamites*. This example must however be referred to *C. germanicus* and is reproduced on our Pl. 69, fig. 2.



Fig. 40.

C. verticillatus ETT. (non L. et H.)
copied from ETtingshausen.

DISTRIBUTION.

Great Britain.

Westphalian series.

Horizon: Houghton Common Rock.

Locality: Hound Hill near Pontefract, Yorkshire. (Type of LINDLEY and HUTTON).

Horizon: Haigh Moor Rock.

Locality: Darton near Barnsley, Yorkshire. (Pl. 156, fig. 7). Collected by W. HEMINGWAY.

Horizon: Barnsley Thick Coal.

Locality: Ward Green, Barnsley, Yorkshire. (Pl. 52, fig. 4, 5). Collected by W. HEMINGWAY.

Lanarkian Series.

Horizon: Shale over "Major Coal."

Locality: No. 3 Pit, Springhill, Crosshouse, Ayrshire, Scotland. (Pl. 52, fig. 7).

Horizon: Hurlford Main Coal.

Locality: Wellington Pit, Kilmarnock, Ayrshire. Collected by A. SINCLAIR.

Horizon: 16—17 Feet below Five-quarter Coal.

Locality: Ardeer Pit, Stevenston, Ayrshire. Collected by J. SMITH.

Netherlands.

Westphalian Series

Equivalent of the Lower "Fettkohle" of the Rheno-Westfalian Coalfield.

Horizon: Seam V.

Localities: Laura en Vereeniging Colliery, near Heerlen, Limburg. (Pl. 52, fig. 6).

Horizon: Shales at 770 m.

Locality: Boring Kessel (10), Peel Basin. (Pl. 51, fig. 2).

Bohemia.

Westphalian Series.

Horizon: ?

Locality: Rakonitz. (Böhmisches Museum, Prag; Pl. 52, fig. 3).

According to WEISS the plant also occurs at the Camphausen-pit near Saarbrücken, but the specimen has not been figured and we have not been able to examine it.

CALAMITES OHLSBACHENSIS STERZEL.

Pl. 48, fig. 4; Pl. 49, fig. 2—7.

1911 *Calamites ohlsbachensis* JONGMANS, Anleitung, I, p. 110, fig. 107.

1907 *Calamitina ohlsbachensis* STERZEL, Karbon und Rothliegendflora Baden, Mitt. Grossh. Badischen Geol. Landesanstalt, V, p. 435, Pl. 67, fig. 1, 1a, 1b, 1c.

DESCRIPTION.

Stem attaining considerable size. Internodes varying in length from 1,5 to 6,5 cm. Outer surface smooth or showing very fine longitudinal fibrillous bands, which here and there anastomose and form elongated meshes. Leaf scars catenulate. Branch scars very small, 3 to 4 mm. in diameter, circular or subcircular, borne on every node, irregularly placed or verticillate, situated immediately above the nodal line.

Pith cast ribbed, ribs with sharp pointed terminations and converging towards the branch scars.

REMARKS.

The type specimen of this species is shown on Pl. 49, fig. 3, of which a portion is enlarged at fig. 4. The leaf scars are not distinctly defined but form a catenulate band at the node. The small branch scar is best seen on the enlargement fig. 4 where it is placed on the central node towards the margin of the figure.

A second small example is given at fig. 5 of which two enlargements are seen at fig. 6 and 7. This specimen is chiefly interesting in that it shows the feeble reticulation of the fibrillous bands on the cortex. It is possible that these are rendered visible through a slight decay of the epidermis.

Another small specimen is shown at fig. 2, which corresponds very closely with that described by STERZEL. It possesses a single branch scar towards the centre of the middle node. The upper surface of this specimen is also slightly decayed and shows faintly the longitudinal fibrillous striation.

The best specimen of the species however is that seen on Pl. 48, fig. 4. Here the internodes are much larger than in the other specimens, but they bear the small circular branch scar characteristic of the species. The cortex is almost smooth and shows only faint indications of the fine longitudinal striations but from the sharp contours of the branch scars on the outer surface it is probably better preserved than on the other specimens.

Parts of the pith cast are seen at the upper and lower nodes of the specimen. The uppermost node shows one scar but at the part where the pith cast is exhibited no scar is present. At the lowest node however where also the pith cast is seen, several branch scars occur, whose position is indicated by the convergence of the ribs towards them. Some of the ribs, especially those seen at the uppermost node, end in sharp points. On this example all the nodes have borne branch scars and it seems probable that on the lowest nodes they were verticillate.

C. ohlsbachensis differs from *C. dictyoderma* in the form and the distribution of the branch scars as well as in having a less pronounced reticulate ornamentation.

DISTRIBUTION.

Baden.

Stephanian Series.

Horizon: Ottweiler Schichten.

Locality: Hinterohlsbach. (Pl. 49, fig. 3–7; Geol. Institute, Freiburg i. Br.)

Great Britain.

Lanarkian Series.

Horizon: Kiltongue Coal.

Locality: Inkerman Pit, Airdrie, Lanarkshire. (Pl. 48, fig. 4).

Horizon: ?

Locality: Thornton Colliery, Crosshouse near Kilmarnock, Ayrshire. (Pl. 49, fig. 2).

CALAMITES DISCIFER WEISS.

Pl. 58, fig. 4; Pl. 61, fig. 4; Pl. 62, fig. 3; Pl. 65, fig. 2; Pl. 67, fig. 2, 3; Pl. 68, fig. 3;
Pl. 78, fig. 2; Text fig. 41–44.

1884 *Calamites (Calamitina) discifer* WEISS, Steink. Calamarien, II, p. 91, Pl. 7, fig. 3.

1911 *Calamites discifer* JONGMANS, Anleitung, I, p. 106, fig. 102, 103.

1911 *Calamites discifer* KIDSTON, (pars), Hainaut, Mém. Musée Roy. d'Hist. Nat. de Belgique, IV, p. 105, Pl. 10, fig. 6, (non fig. 5).

1913 *Calamites discifer* JONGMANS and KUKUK, Calam. Rhein. Westf. Kohlenbeckens. Meded. Rijks Herbarium, Leiden, No. 20, p. 33, Pl. 14, fig. 2–3.

1884 *Calamitina discifera* WEISS, Steink. Calamarien, II, On explanation to Pl. 7, fig. 3.

1884 *Calamites (Calamitina) pauciramis* WEISS, Steink. Calamarien, II, p. 93, Pl. 11, fig. 1.

1903 *Calamites pauciramis* KIDSTON, Canonbie, Trans. Roy. Soc. Edinburgh, XL, p. 789, Pl. 4, fig. 36; Pl. 5, fig. 44.

1911 *Calamites pauciramis* JONGMANS, Anleitung, I, p. 105, fig. 101.

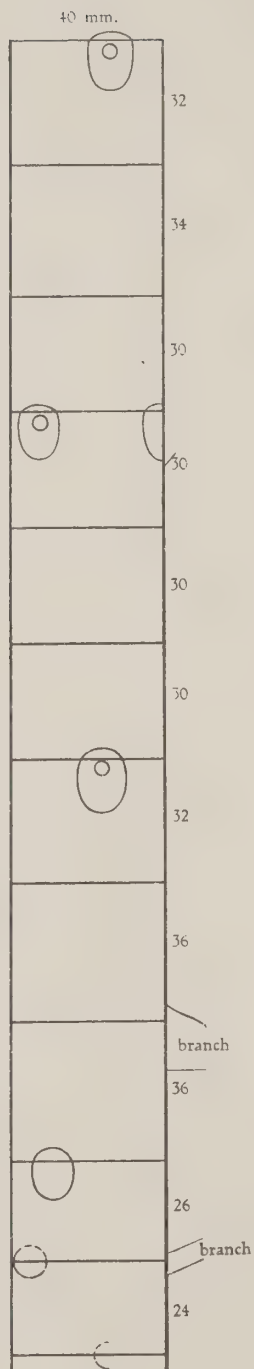
1884 *Calamitina pauciramis* WEISS, Steink. Calamarien, II, Explanation to Pl. 11, fig. 1.

1876 *Equisetites infundibuliformis* O. FEISTMANTEL, (pars), Böhmen, Palaeontogr., XXIII, Pl. 1, fig. 5.

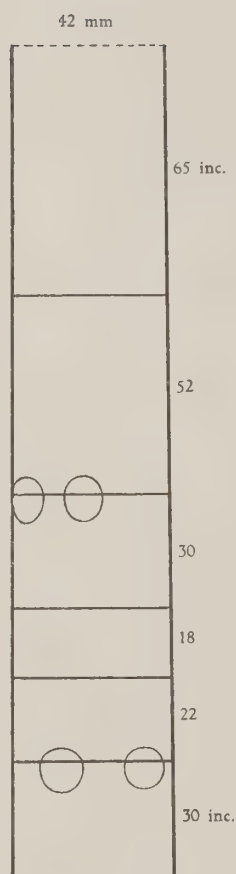
1887 *Calamites germanianus* STUR, (pars), Calam. schatzl. Schichten, p. 174.

DESCRIPTION.

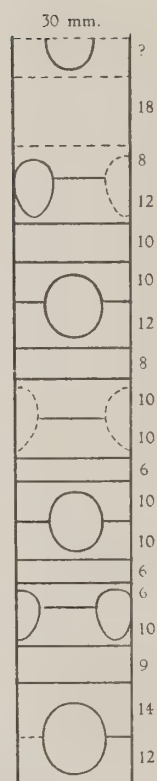
Stem attaining a width of 5 cm. or more. Internodes from 0,5 to 5,5 cm. long, varying much on the same specimen irrespective of the branch development.



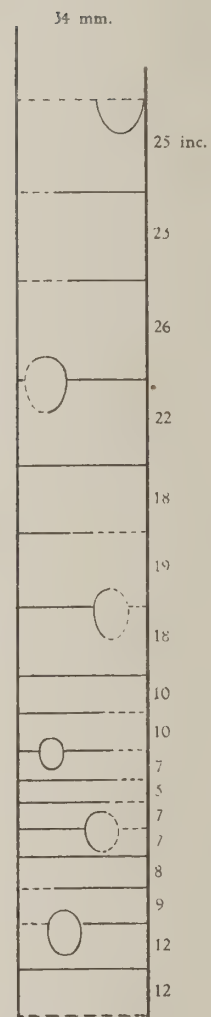
Text fig. 41.
Diagram of the complete specimen, from which part has been figured on Pl. 78, fig. 2.



Text fig. 42.
Diagram of the specimen shown on Pl. 65, fig. 2.



Text fig. 43.
Diagram of the specimen shown on Pl. 68, fig. 3.



Text fig. 44.
Diagram of the specimen shown on Pl. 67, fig. 3.

Outer surface smooth, with a fine longitudinal fibrillous striation and occasionally having numerous longitudinal cracks.

Branch scars placed at the upper ends of the internodes varying in form from circular to subtriangular and attaining a diameter of 1,75 cm.

Leaves lanceolate-setaceous, 2 cm. or more in length, single veined, apparently free at the base.

Leaf scars imperfectly preserved.

Pith cast unknown.

REMARKS.

If one had only to deal with the specimens seen on Pl. 78, fig. 2 and on Pl. 68, fig. 3 one might well regard them as two distinct species and so they have been treated by WEISS. But if these two fossils be compared with the example on Pl. 67, fig. 3 it will be seen that the stem given on Pl. 78, fig. 2 agrees with the upper part of Pl. 67, fig. 3 and that fig. 3, Pl. 68 agrees with the lower part of Pl. 67, fig. 3. We are therefore led to the conclusion that there are no satisfactory grounds for retaining as distinct species the *C. discifer* WEISS and the *C. pauciramis* WEISS.

The specimen given at fig. 2, Pl. 78, and of which a diagram is seen at Text fig. 41, is the lower portion of the specimen given by WEISS in Calam., II, Pl. 11, fig. 1. Here the internodes are of almost equal length and bear one or two branch scars separated generally by two non-branch bearing internodes though branches may be borne on the intermediate nodes, as seen at the top of the original figure of WEISS and at Text fig. 41. The surface of this fossil bears longitudinal cracks or striations. The branch scars are subtriangular, placed on the top of the internodes and extend only slightly above the nodal line.

A very similar example is given on Pl. 65, fig. 2 where the internodes on the lower part are much shorter than those on the upper part of the specimen. This is well seen in the diagram given at Text fig. 42. The general character of this specimen, the form of the branch scars and the surface of the stem is almost identical with that just described. (Pl. 78, fig 2).

Another, but smaller example, is given on Pl. 67, fig. 2. Here four of the nodes bear branch scars separated periodically. The branch scars seen on the second and fifth node from the top are larger than those seen on the eighth and eleventh nodes, which are also associated with shorter internodes. The upper scars are more subtriangular than those at the base of the specimen, the latter approaching more in form to those at the base of the example given on Pl. 68, fig. 3.

On Pl. 68, fig. 3 and at Text fig. 43 is reproduced the original specimen of *C. discifer* WEISS. Seven of the nodes of this specimen bear branch scars. The second scar from the top is subtriangular, and absolutely identical with some occurring on the specimen given on Pl. 65, fig. 2. Again on the specimen seen on Pl. 67, fig. 3, the branch scars towards the top are subtriangular, others at the bottom are subcircular and are only slightly

narrower than those occurring at the base of the type of *C. discifer*. (Pl. 68, fig. 3). In fact this type specimen of *C. discifer* possesses itself scars identical in form and distribution with those of *C. pauciramis* while others are circular and extend almost equally over the two contiguous internodes. It is therefore impossible to regard *C. discifer* and *C. pauciramis* as specifically distinct. The specimen shown at fig 3, Pl. 67 also combines the two characters which are supposed to separate the two species. In the type of *C. discifer* the internodes are all short and on the specimen given on Pl. 67, fig. 3 and at Text fig. 44, the lower internodes are short whereas the upper ones are much more elongated.

On Pl. 58, fig. 4 a small fragment is figured, which shows a single circular scar, somewhat extending over both internodes. The chief interest of this specimen is however in the presence of the leaves which are still attached to the three upper nodes. They are lanceolate-setaceous, single nerved, about 2 cm. long and appear like all the other Calamite leaves of this type to be of a rigid nature. Their upright direction shows that the branch scars are borne at the upper ends of the internodes.

Another small specimen with a circular scar is given on Pl. 61, fig. 4 and here as in almost all cases, where the scar is circular, it extends equally over the neighbouring internodes.

On the stem seen at fig. 3, Pl. 62, the branch scars are subtriangular and as is usual for those of this form, mostly extend downwards from the summit of the internode on which they sit. The bark is also very much longitudinally cracked.

C. discifer, though closely related in some respects to *C. germanianus* is distinguished by its smaller scars which are very irregularly placed, both as to their occurrence on the nodes and in their relationship to each other. In *C. germanianus* the branch scars are larger and form complete verticils separated by a period of two or more branchless internodes.

DISTRIBUTION.

Great Britain.

Westphalian Series.

Horizon: Bed between Three-quarter Coal and Main Coal.

Locality: River Esk, left bank, about 30 yards below junction of Byre Burn, Canonbie, Dumfrieshire, Scotland. (Pl. 58, fig. 4; Pl. 61, fig. 4).

Horizon: Thick Coal.

Locality: Ward Green, Barnsley, Yorkshire. Collected by W. HEMINGWAY. (Pl. 62, fig. 3).

Belgium.

Westphalian Series.

Horizon: ?

Locality: Colliery Sart les Moulins, Pit No. 6, at Souvret. (Pl. 65, fig. 2; Mus. Hist. nat. Bruxelles).

Germany.

Westphalian Series.

Rheno-Westfalian Basin.

Magerkohle.

Horizon: Seam 4. (Mausegatt-Hundsnocken).

Locality: Colliery Franziska-Tiefbau near Witten. (Pl. 67, fig. 2; Geol. Landesanstalt, Berlin).

Horizon: ?

Locality: Colliery Helene near Witten. (Pl. 67, fig. 3; Geol. Landesanstalt, Berlin).

Lower Silesia.

Schatzlarer Schichten.

Horizon: Seam 7.

Locality: Glückhelf Colliery, Hermsdorf. (Pl. 68, fig. 3; Geol. Landesanstalt, Berlin).

Horizon: 5th Rain Seam.

Locality: Gustav Colliery, Gottesberg. (K.K. Geol. Reichsanstalt, Wien, named *C. germanianus* by STUR).

Horizon: ?

Locality: Sophien Colliery near Charlottenbrunn. (Pl. 78, fig. 2; Geol. Landesanstalt, Berlin).

Bohemia.

Locality: Not known with certainty. (Radnitz or Pilsen, cf. WEISS, Steink. Calam., II, p. 93), (*Equisetites infundibuliformis* FEISTMANTEL, pars).

CALAMITES GERMARIANUS GOEPPERT.

Pl. 58, fig. 2; Pl. 69, fig. 2; Pl. 138, fig. 2; ? Pl. 71, fig. 1, 2; Text fig. 45, 46.

1852 *Calamites germanianus* GOEPPERT, Uebergangsgebirge, Nov. Act. Acad. Car. Leop. Nat. Cur., XIV, (XXII), Suppl., p. 122, Pl. 42, fig. 1.

1887 *Calamites germanianus* STUR, (references in part), Calam. schatzl. Schichten, p. 174, Pl. 14, fig. 2, (non Pl. 14 b, fig. 5, non Pl. 15 b, fig. 1).

1911 *Calamites germanianus* JONGMANS, Anleitung, I, p. 104, fig. 100.

1874 *Calamites verticillatus* WILLIAMSON, (non L. et H.), On the organization, V, Phil. Trans. Roy. Soc., London, CLXIV, p. 66, Pl. 7, fig. 45.

1887 *Calamites williamsonis* STUR, Calam. schatzl. Schichten, p. 178.

- 1884 *Calamites (Calamitina) macrodiscus* WEISS, Steink. Calam., II, p. 94, Pl. 11, fig. 2.
 1911 *Calamites macrodiscus* JONGMANS, Anleitung, I, p. 108, fig. 104.
 1884 *Calamitina macrodiscus* WEISS, Steink. Calam., II, Explanation to Pl. 11, fig. 2.
 1911 *Calamites discifer* KIDSTON, (non WEISS), Hainaut, Mém. Musée Roy. Hist. Nat. de Belgique, IV, p. 105, Pl. 10, fig. 5.

DESCRIPTION.

Stem large. Most of the internodes of about equal length, broader than long, almost smooth, with longitudinal cracks.

Branch scars large, verticillate, touching or slightly distant, attaining a size of 2,75 cm. long by 2,30 cm. broad. Umbilicus central, usually very prominent. Whorls always separated, as far as observed, by three internodes. Leaves lanceolate, setaceous, apparently free, 2 cm. or more long. Leaf scars unknown.

Pith cast not known with certainty.

REMARKS.

The small specimen given at fig. 2, Pl. 58 shows at one of the nodes two large scars one of which is 2,75 cm. long and nearly 2,30 cm. wide, but the other is somewhat smaller. At the third lower node the remains of another verticil are seen, separated from the upper one by three internodes.

The bark is smooth with a very fine striation. To the nodes of this specimen, as also on that given under the name of *C. discifer* by KIDSTON (1911), the leaves are attached. They are lanceolate setaceous and from their direction show that the branch scars are borne at the summits of the internodes.

A portion of another stem is given on Pl. 69, fig. 2, but unfortunately it is placed in inverted position, as the scars are known to be borne at the top of the internodes, not at their base, as represented in the figure. On this specimen the branch verticils are separated by three internodes and that above the branch whorl is generally shorter than the two others. The branch scars are closely placed and slightly deformed from mutual pressure. This specimen is the original of *C. williamsonis* STUR and had previously been figured by WILLIAMSON under the name of *C. verticillatus*.

Portion of another example is given on Pl. 138, fig. 2, of which a diagram is seen in our Text fig. 45. The lowest whorl at the base of the figure shows two large branch scars, slightly distant and between them is seen the faint trace of a circle partially overlapping the two

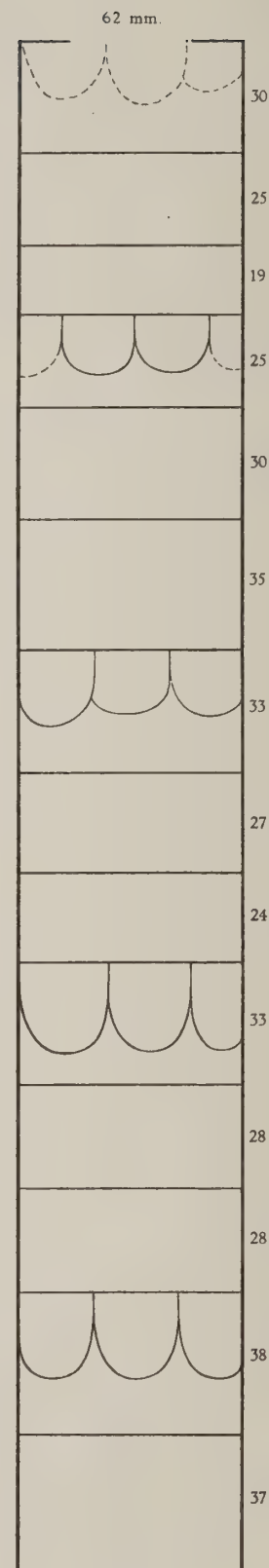


Fig. 45.
 Diagram of the
 specimen shown on
 Pl. 138, fig. 2.

csars. To the right margin of the same whorl another circle is seen faintly overlapping the scar lying on its left. These two faint circles appear to be the impression of two branch scars on the opposite side of the stem.

Our Text figure 46 is a reproduction of the figure given by STUR of GOEPPERT's type of *C. germanianus*. There is a greater variation in the size of the branch scars in this specimen than in any one of the other examples known to us. The largest branch scar here is 3,2 cm. long and the one next to it in the same whorl is only 2 cm. long. The umbilicus also is more eccentric in the larger branch scars of the specimen, being placed nearer to their upper margin.

The affinities of this species are with *C. discifer*, from which it differs by its larger scars and their regular verticillate distribution.

We have stated in the description of this species that the pith cast is unknown, but there is given on Pl. 71, fig. 1, 2 the two sides of a pith cast which in the arrangement of the branch scars, separated by a period of three internodes and in the size of these internodes in relation to each other agrees so entirely with what one might expect the pith cast of *C. germanianus* to show that we provisionally place it under that species.

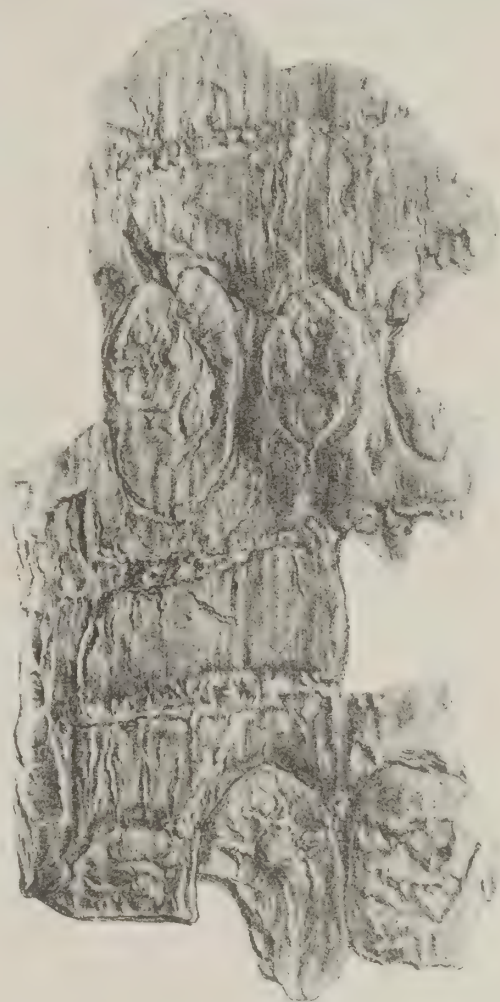


Fig. 46.

C. germanianus GOEPP.
(copied from STUR).

DISTRIBUTION.

Westphalian Series.

Great Britain.

Locality: Barnsley Coalfield, Yorkshire. (Pl. 138, fig. 2; Victoria University Museum, Manchester).

Locality: Lancashire. (Pl. 69, fig. 2; Victoria University Museum, Manchester).

Belgium.

Horizon: Seam aux Laies.

Locality: Collieries of Mariemont, Pit Placard. (Pl. 58, fig. 2; Coll. DELTENRE).

Germany.

Horizon: Muldengruppe.

Locality: Agnes Amanda Colliery in Upper Silesia. (Text fig. 45).

Horizon: Schatzlarer Schichten.

Localities: Gustav Colliery, Schwarzwaldau, Alexander Pit, Seam 7. (Pl. 71, fig. 1, 2; ? Pith cast; Geol. Landesanstalt, Berlin).

Glückhilm Colliery near Hermsdorf, Lower Silesia. (*C. macrodiscus* WEISS; Geol. Landesanstalt, Berlin).

CALAMITES BRITTSII (D. WHITE) KIDSTON et JONGMANS emend.

Pl. 62, fig. 4; Pl. 63, fig. 1, 2, 3; (? Pl. 65, fig. 3, 4, 5). Textfig. 47—49.

1899 *Cyclocladia brittsii* D. WHITE, U. S. Geol. Surv., Monogr., XXXVII, p. 169, Pl. 49, fig. 1.

1843 (?) *Calamites tripartitus* GUTBIER, Gaea von Sachsen, p. 69.

1884 *Calamites tripartitus* WEISS, (pars), Steink. Calamarien, II, p. 89.

1911 *Calamites tripartitus* JONGMANS, (pars), Anleitung, I, p. 102, (non fig. 99).

1887 *Calamites germanianus* STUR, (pars), Calam. schatzl. Schichten, p. 174, Pl. 14b, fig. 5.

1855 *Equisetites infundibuliformis* GEINITZ, (pars), Sachsen, p. 3, Pl. 10, fig. 4.

1869 *Macrostachya infundibuliformis* SCHIMPER, (pars), Traité, I, Pl. 23, fig. 13.

1879-80 *Macrostachya infundibuliformis* LESQUEREUX, (pars), Coal Flora, I, p. 60, Pl. 3, fig. 14.

1884 *Macrostachya infundibuliformis* LESQUEREUX, (pars), 13th Rept. Geol. Surv. Indiana, p. 47, Pl. 5, fig. 7, (non Pl. 4, fig. 7, 8).

1897 *Cyclocladia species* D. WHITE, Bull. Geol. Soc. America, VIII, p. 297.

DESCRIPTION.

Internodes with exception of those bearing the branch verticils very short, 1 to 1.5 cm. or more long, 8 cm. or more broad, smooth, with very fine longitudinal fibrillous striations.

Larger branch scars about 2 cm. wide, smaller branch scars about 1 cm. wide. Scars on the larger verticils subquadrate, approximate, deformed laterally by mutual pressure, and having a large central umbilicus. Smaller scars circular, more or less distant, with large umbilicus.

Leaf scars obscure, pith cast imperfectly known.

REMARKS.

This species is very imperfectly known and its specific rank must stand in doubt until more perfect specimens are discovered. On the specimen figured by WHITE and that given by STUR under the name *C. germanianus* (non GOEPPERT) only whorls of large branch scars are present, whereas in the figure given by GEINITZ (which has been copied by SCHIMPER), and that given by LESQUEREUX, two verticils, one of large and one of small scars are shown.

On our Pl. 62, fig. 4 we reproduce the example given by STUR under the name

of *C. germanianus*. The branch scars are almost quadrate through lateral pressure, and have a large, somewhat eccentric umbilicus.

The same form of scar occurs on the example given by WHITE, (Text fig. 47), though the umbilicus is not clearly seen in his figure. The one point of difference

between these two specimens lies in the branch verticils being separated by three internodes in STUR's specimen and by 7 internodes in WHITE's example.

To return to the two specimens figured by GEINITZ (Text fig. 48) and LESQUEREUX, (Text fig. 49), which have a remarkable similarity to each other, each shows a verticil of large and one of small branch scars separated by three internodes. Both these specimens show a small portion of the internal cast, on which according to the figures, the ribs alternate at the nodes and are sharp pointed, but as no detailed description of this part of the stem has been given by either of the authors it is safer to refrain from definitely adding to the description of the species characters represented on the figures for which the artist may be in part responsible.

Three small examples, which we refer to this species, are given on Pl. 63, fig. 1, 2, 3. Fig. 1 shows a portion of a verticil of large scars surmounted by four very short internodes. The scars are somewhat flattened laterally from mutual pressure and the internodes are finely

striated longitudinally. Fig. 2 shows also a part of a branch verticil, below which are the remains of the two internodes, longer than the internodes seen on other specimens of this species except internodes on which branch scars occur. At fig. 3 is given another small fragment where the striations on the internodes seen above the branch scars are very strong and clearly marked.

On Pl. 65 at fig. 3, 4, 5 are shown different views of the same specimen. Fig. 3 fits on to the surface of fig. 5 and fig. 4 is what appears on the back of the specimen. The two cone like branches here with long, narrow, linear foliage can be traced to their bases which fit on to the large scars. These branch scars have a great similarity to those occurring on *C. brittsii* but the specimen is too fragmentary to definitely refer it to that species, where however it is provisionally placed. The cone like body shown at fig. 4 is too imperfectly preserved to yield any details of its structure.



Fig. 47.

Calamites brittsii,
copied from WHITE's original figure.

As after mentioned *C. brittsii* holds a close relationship to *C. crassicaulis* of RENAULT and differs chiefly in the larger scars being closely placed together and subquadrate through mutual pressure.

It is stated by STUR (Calam. schatzl. Schichten, p. 177) that the two specimens figured by GEINITZ on Pl. 10, fig. 4, 5 have been labelled by GUTBIER as *C. tripartitus*, a name published by him in Gaea von Sachsen, 1843, p. 69 without figure or detailed description. Of the two specimens mentioned by STUR, fig. 5 is *C. goepperti* and therefore must be removed from *C. tripartitus*, and of the other specimen (fig. 4), no published description or figure bearing the name of *C. tripartitus* is known to us. We are therefore bound to adopt the name of *C. brittsii* WHITE for this species as it is the only one that has been accompanied by a figure and description. GUTBIER's original name is still merely a manuscript one.

DISTRIBUTION.

U. S. America.

Localities: Owen's Bank, Missouri. (WHITE).
Henry County, Missouri. (WHITE).
Nodules of Mazon creek, Cannelton Coal.
(LESQUEREUX).

Belgium.

Westphalian Series.

Localities: Forchies. (Pl. 63, fig. 2, 3). (Musée d'Hist. nat., Bruxelles).

Belle et Bonne, Hainaut. (Pl. 63, fig. 1).
(Musée houiller, Louvain).

Germany.

Westphalian Series.

Schatzlarer Schichten.

Locality: Ruben Colliery near Neurode. (STUR, Pl. 62, fig. 4). (Zwinger Museum, Dresden).

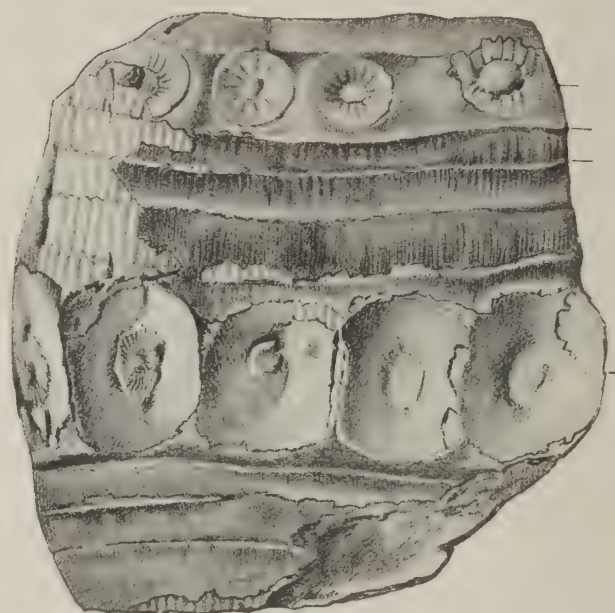


Fig. 48.

Calamites brittsii WHITE copied from GEINITZ
(*Equisetites infundibuliformis*).

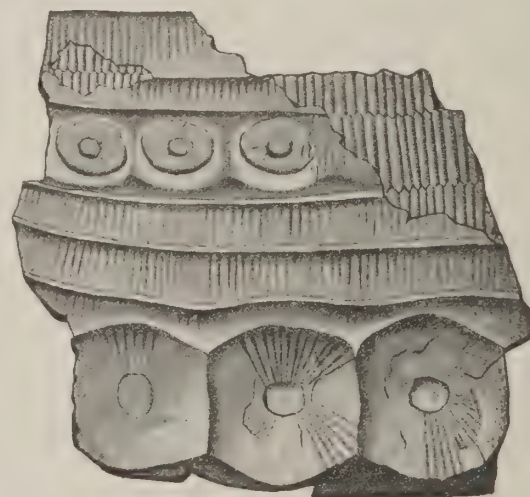


Fig. 49.

Calamites brittsii WHITE
copied from LESQUEREUX
(*Equisetites infundibuliformis*).

Niederschlesischer Hangendzug.

Locality: Melchior Colliery near Dittersbach. (Pl. 65, fig. 3, 4, 5). (Geol. Landesanstalt, Berlin).

Saxony.

Westphalian Series.

Locality: Scherbenkohl Seam of Oberhohndorf. (GEINITZ).

CALAMITES PSEUDOGERMARIANUS KIDSTON et JONGMANS n.sp.

Pl. 59, fig. 4; Pl. 64, fig. 1; Pl. 68, fig. 4, 5.

1912 ? *Calamites ? varians* ARBER, Forest of Dean, Phil. Trans. Roy. Soc. London, Ser. B, Vol. CCII, pp. 241, 281, Pl. 13, fig. 15.

DESCRIPTION.

Internodes broader than long, varying in length from 1,5 to 4,5 cm. with a width of 16 cm. or more. Surface smooth with very fine fibrillous longitudinal striations and cracks. Branch scars verticillate, periodic, separated by 3 to 7 internodes, large, more or less circular or slightly oval, touching each other laterally or slightly distant and attaining a diameter of 3,5 cm. and almost as large as the internode or only slightly less. Umbilicus central or eccentric.

Leaf scars somewhat obscure, apparently catenulate.

Foliage and pith cast unknown.

REMARKS.

Calamites pseudogermarianus, *C. crassicaulis* and *C. brittsii* form a group about whose specific position there is room for some doubt. At present there are few perfect specimens from which one can obtain the necessary data for a satisfactory discrimination of the species. It has therefore been deemed necessary to treat them as specifically distinct until more examples of them have been found.

A fine specimen of what is described here as *C. pseudogermarianus* is given on Pl. 64. It shows two verticils of branch scars, of which the scars forming the upper verticil are only about half the size of those forming the lower one.

Another specimen given on Pl. 68, fig. 4 shows parts of two verticils here only separated by three internodes. The scars are somewhat irregular in form but only slightly differ from those seen on Pl. 64, being somewhat more transversely oval.

At fig. 5, Pl. 68, a small fragment is given showing two scars. They are slightly longitudinally oval. Another small fragment is seen on Pl. 59, fig. 4 where of the two most perfect scars exhibited, one is subcircular and the other oval.

All these specimens however have the same general facies and it is impossible to separate them specifically.

To this species may perhaps be referred provisionally a specimen figured by ARBER under the name of *C. ? varians*.

C. pseudogermanianus differs from *C. germanianus* in the form of its branch scars which are circular and have little or no lateral deformation. The same character separates it from *C. brittsii*, where the internodes also seem to be shorter and although the scars vary in size in *C. pseudogermanianus* they are however almost always larger than in *C. brittsii*.

C. crassicaulis is distinguished from *C. pseudogermanianus* by the short internodes, which seem to be a very constant character in that species.

DISTRIBUTION.

Great Britain.

Westphalian Series.

Horizon: Parkgate Coal.

Locality: Dodworth near Barnsley. (Collected by W. HEMINGWAY). (Pl. 59, fig. 4).

Germany.

Westphalian Series.

Horizon: Obere Muldengruppe, Upper Silesia.

Locality: Boring Oschin II, 232 m. (Pl. 68, fig. 4). (Geol. Landesanstalt, Berlin).

Horizon: Hangendzug, Lower Silesia.

Locality: Glückhelf Colliery near Hermsdorf. (Pl. 68, fig. 5). (Geol. Landesanstalt, Berlin).

Bohemia.

Stephanian Series (Lower part).

Locality: Frisch Glück Pit near Pilsen. (Pl. 64). (Historisches Museum, Pilsen).

CALAMITES CRASSICAULIS RENAULT sp.

Text fig. 50.

1888 *Macrostachya crassicaulis* RENAULT, Commentry, Pl. 51, fig. 1, 2, (? 3), (*pars*); Text, II, 1890, p. 421.

1898 *Macrostachya crassicaulis* RENAULT, Notice sur les Calamar., III, Bull. Soc. hist. nat. Autun, XI, p. 44, Pl. 10, fig. 1, 2.

1911 *Macrostachya crassicaulis* JONGMANS, Anleitung I, p. 51, fig. 64; p. 344, fig. 308.

DESCRIPTION.

Stem large. Internodes very short, from less than 0,7 cm. to 1,25 cm. long and 12 to 15 cm. or more wide. Outer surface smooth. Branch scars verticillate, separated by 5 to 6 internodes. Large and small circular branch scars occupy alternate verticils, the larger attaining a diameter of 3 cm., the smaller that of 1,5 cm.; both have a large central umbilicus.

Leaf scars and pith cast unknown.

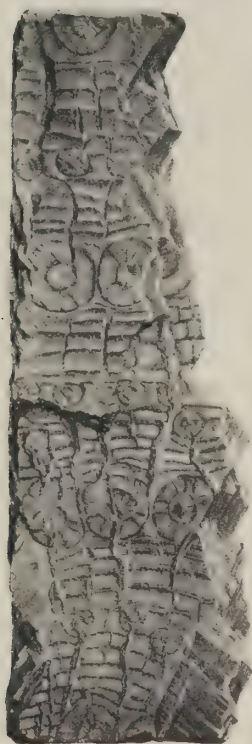


Fig. 50.

Calamites crassicaulis RENAULT.
Reduced copy from
RENAULT's original
figure.

REMARKS.

The only specimens of this species are those described by RENAULT under the name of *Macrostachya crassicaulis*. With these he unites certain fragments of *Macrostachya* cones which are adhering to the surface of one of his specimens. These he believed were borne by the verticils of smaller scars, whilst the larger scars were those from which true branches had been removed. It is possible, that these cones belong to *C. crassicaulis*, but the proof of their organic union to the stem is not satisfactory. We therefore exclude from this species his fig. 3 and the remains of the cones lying upon the face of his fig. 2.

C. brittsii WHITE shows a great similarity to *C. crassicaulis* but appears to differ in its subquadrate, closely placed branch scars and also in the fewer number of internodes forming the period.

A figure showing similarity to *C. crassicaulis* is that of *Calamophyllites geinitzii* G. E. (Gard, Pl. XIV, fig. 1). This specimen shows two verticils of smaller scars placed on neighbouring internodes, above which, and separated by a very few short internodes, is a verticil of large scars.

DISTRIBUTION.

France.

Stephanian Series.

Horizon: Shales intercalated in the second seam.

Locality: Commentry, Western Trench. (Musée d'Hist. nat., Paris).

CALAMITES SCHÜTZEI STUR.

Pl. 76, fig. 1, 2; Pl. 81, fig. 2, 3; Pl. 157, fig. 4; Text fig. 51.

1881 *Calamites schützei* STUR, Sitzungsber. k. Akad. d. Wiss. Wien, LXXXIII, I. Abt., p. 416, Pl. 1, fig. 1.

1887 *Calamites schützei* STUR, (pars), Calam. schatzl. Schicht., p. 131, Pl. 17, fig. 2.

1913 *Calamites schützei* JONGMANS and KUKUK, Calam. Rhein. Westf. Kohlenb., Mededeel. Rijks Herbarium, Leiden, No. 20, p. 30, Pl. 15, fig. 2, 3.

DESCRIPTION.

Stems attaining a width of about 6 cm. or more. Nodes longer than broad or broader than long.

Outer surface smooth with distinct longitudinal regular and straight fibrillous markings.

Branch scars periodic, large, quadrate, about 1,1 cm. in diameter with central umbilicus. Shortest node immediately over the branch scars above which they very slightly increase in length. Number of internodes in a period between branch bearing nodes unknown. Leaf scars transversely oval, catenulate.

Pith cast only little constricted at the nodes, but slightly swollen at the node bearing the branch scars. Ribs flattened, separated by a shallow furrow, ornamented with a narrow band of delicate cross-hatching, bluntly pointed, with small elongated tubercles at their upper ends; converging very slightly towards the branch scars.

Pith cast generally shows the remains of the wood cylinder which appears as a smooth band extending along its margins.

REMARKS.

The pith cast of the specimen shown on Pl. 76, fig. 2 seems to agree absolutely with the original figure of *C. schützei* given by STUR. (1881, Pl. 1, fig. 1). The nodes are only very slightly constricted and the internodes gradually and regularly increase in size upwards from the branch bearing node.

On the wood surrounding the cast a very slight furrow extends straight outwards from the nodes across the wood zone. This is distinctly seen in both STUR's and our own figures, and may represent the channel through which a vascular strand has passed to some appendicular organ. The fine cross-hatching on the centre of the ribs, from its delicate nature, could only be observed on exceptionally well preserved specimens, but is well seen on this example. It is also faintly indicated on that given on Pl. 81, fig. 2. On the former of these two specimens the tubercles are very indistinctly seen but on the later they are more clearly exhibited and are slightly elongated.

At certain parts the outer surface is faintly striated longitudinally, while at others it appears to be quite smooth. The branch scars are almost quadrate through mutual pressure.

One of the most interesting points exhibited by the specimen shown on Pl. 76, fig. 1 and 2, is the different proportion in the size of the internodes as shown by the pith cast when compared with the corresponding internodes as seen on the outer surface. The proportional lateral difference between the corresponding internodes results from the addition of wood and cortex, which adds greatly to their breadth while no increase takes place in their length. Hence the internodes of the pith cast are longer in proportion to their width than those exposed on the outer surface of the cortex. Special attention might be directed to the internode below and the one above the branch bearing node. On the

pith cast the lower internode is 2,1 cm. high, while the upper one is only 0,9 cm. high. These two internodes measured on the outer surface appear to be each 1,5 cm. long. This however does not give the true length of these two internodes. The true nodal line is obscured by the branch scars and in reality passes through the centre of their umbilicus. The apparent nodal line below the branch scars is caused by the pressure of the base of the branch on the cortex. This explains why one so rarely sees the leaf

scars preserved at the lower margins of the branch scars. If then we measure the length of the two internodes on the outer surface of the stem from the centre of the branch scars it will be found that the length of these so measured corresponds with those of the pith cast.

The relationship of the pith cast to the outer surface of the stem is seen in our Text fig. 51. The outer solid lines A.A. represent the limits of the bark. The two inner dotted longitudinal lines C.C. represent the limit of the pith cavity and the solid transverse lines the nodes as seen on the outer surface and on the pith cast. B.B. shows the whorl of branch scars with their central umbilicus. At D a dotted line is seen on the pith cast going through the umbilicus of the scars. This is the real nodal line on which the branch scars are situated, but as already mentioned, it is not visible on the outer surface, being effaced by the branch scars.

On Pl. 81, fig. 2 is given another specimen of *C. schützei*. On the lowest node shown on the figure a few branch scars are faintly indicated. This specimen has very slightly constricted nodes, somewhat flat ribs with elongated tubercles at their upper ends, divided by shallow furrows and a gradual increase in the length of the internodes upwards, — characters all very typical of *C. schützei*.

Another example is given on Pl. 81, fig. 3. Though very fragmentary it illustrates very well the general appearance of the pith cast of this species, which in this case is bordered at each side by the impression of the wood zone.

The majority of specimens which have been referred to *C. schützei* are included by us under the new name of *C. schützeiformis*. These seem to differ from *C. schützei*, as originally described by STUR (l. c.), in the irregularity in the length of the internodes and in their being slightly more constricted at the nodes.

It is quite possible that some of the specimens which we exclude from *C. schützei*, either figured by others or figured here, may belong to the true *Calamites schützei*, but in the present state of our knowledge we cannot recognise them as belonging to that species.

These specimens are therefore separated and distinguished by the name of *C. schützeiformis*.

Without an examination of the specimen described as *C. schützei* by HORWOOD,

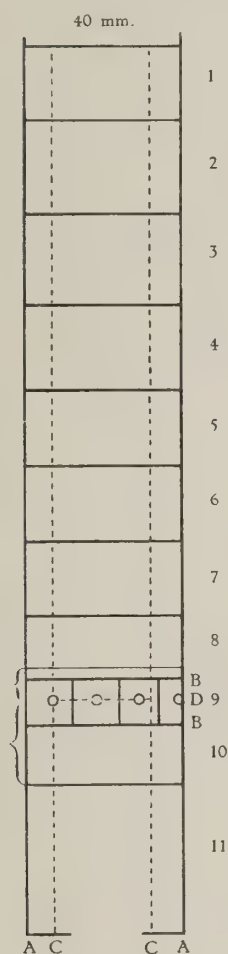


Fig. 51.
Diagram of
the specimen
shown on
Pl. 76, fig. 1, 2.

(Journ. Linn. Soc. Bot., Vol. XXXIX, 1910, Pl. 19) it is impossible to determine whether his fossil belongs to that or another species. That figured on his Pl. 18 must be referred to *C. schützeiformis* var. *typicus*.

The characters by which *C. schützei* is separated from the pith casts included under the name of *C. schützeiformis* are its less prominent ribs, less constricted nodes and the regular upward increase in length of the internodes forming the periods.

DISTRIBUTION.

Westphalian Series.

Netherlands.

Horizon: 4 m. over Seam VII.

Locality: Wilhelmina Colliery, near Heerlen, Limburg. (Pl. 76, fig. 1, 2).

Germany.

Rheno-Westfalian Coalfield.

Horizon: Fettkohle; Seam Ludwig.

Locality: Colliery Constantin. (Pl. 81, fig. 2). (Berggewerkschaftskasse, Bochum).

Colliery Hibernia. (Pl. 81, fig. 3). (Berggewerkschaftskasse, Bochum).

France.

Bassin du Nord.

Locality: Anzin Collieries near Valenciennes. (STUR, 1881, Pl. 1, fig. 1).

Great Britain.

Horizon: Barnsley Thick Coal.

Locality: Monckton Main Colliery near Barnsley. (Collected by W. HEMINGWAY).

Collection KIDSTON, No. 1912. (Pl. 157, fig. 4).

CALAMITES VANDERGRACHTI, KIDSTON et JONGMANS n. sp.

Pl. 69, fig. 3, 4; Pl. 70, fig. 1—5.

DESCRIPTION.

Outer surface. Stem 4.5 cm. or more wide. Internodes shorter than broad or longer than broad. Outer surface of cortex smooth with very fine longitudinal fibrillous striations. Branch scars periodic, elongate-quadrate, bounded above and below by an almost straight line. Umbilicus central. Leaf scars small, circular, distant and separated from each other by a strongly striated band, about twice as long as the width of the leaf scars.

Pith cast. Margins of pith cast straight with almost no indication of contraction at the nodes. Ribs prominent, narrow, divided by straight furrows. Tubercles and termina-

tions obscure. In the great majority of cases the ribs do not alternate at the nodes but pass straight over them. Surface of ribs ornamented with a fine granular punctation.

Ribs strongly converging towards the branch scars.

REMARKS.

Only three specimens of this species are known to us, all of which have been derived from the Dutch coalfield. The most perfect is given at fig. 1, Pl. 70 which shows the impression of a stem. A part of the pith cast of the same example is given at fig. 5 of the same plate. This example also shows what has already been mentioned in the description of *C. schützei* that the umbilicus marks the position of the nodal line from which the branches arise but which becomes invariably obliterated by the branch scars.

One remarkable feature in this species and in others of the same group is the non-alternation of the ribs at the nodes. The leaf scars are very beautifully shown on the node immediately above the branch verticil and are given enlarged on Pl. 69, fig. 4. They are very small, circular, 1,5 mm. in diameter and separated from each other by a muriform band which is strongly striated longitudinally.

The pith cast shows a strong convergence of the ribs towards the branch scars.

Another pith cast is given on Pl. 69, fig. 3. No branch scars are shown here, but it exhibits the regularity in the length of the internodes and also the almost entire absence of any constriction at the nodes, which is seen by the straight margin of the cast. The cast is also bordered by the impression of a narrow wood zone.

A third example of this species is given on Pl. 70, fig. 4 and a small part which was removed from its surface is seen at fig. 2 of the same plate. These two figures give a very clear idea of the outer surface of the bark. The upper end of fig. 4 bears a branch verticil, which appears as a solid band across the fossil. A few of the leaf scars of this specimen are enlarged at fig. 3 and show the same structure as those given on Pl. 69, fig. 3.

This plant differs from *C. schützei* in its prominent ribs, the straight borders of the pith cast and the circular form of the leaf scars.

The leaf scars are very similar to those of *C. semicircularis* (Pl. 47, fig. 5) but the band connecting them in that species narrows in the middle and is not quadrate as in *C. vandergrachtii*. The branch scars in the two species are however quite dissimilar.

We have pleasure in naming this species after Mr. VAN WATERSCHOOT VAN DER GRACHT who has taken much interest in this work.

DISTRIBUTION.

Westphalian Series.

Netherlands.

Horizon: Seam VI. (Pl. 69, fig. 3, 4; Pl. 70, fig. 1, 5).

Seam V. (Pl. 70, fig. 2, 3, 4.)

Locality: Wilhelmina Colliery, near Heerlen, Limburg.

CALAMITES SCHÜTZEIFORMIS KIDSTON et JONGMANS.

DESCRIPTION.

Pith cast 19 cm. or more wide. Internodes from 2 mm. to 9 cm. long contracted at the nodes, those with short internodes having a barrel shape contour. Ribs straight, generally prominent, divided by a narrow furrow.

Branch scars verticillate, periodic, to which the ribs strongly converge. Periods composed of a varying number of internodes.

Ribs frequently not alternating at the nodes, tubercles almost invariably obscure.

REMARKS.

Under the name of *C. schützeiformis* are included a number of pith casts which, though they possess certain characters in common, we believe to belong to more than one species but which do not offer sufficiently distinctive characters for their satisfactory separation.

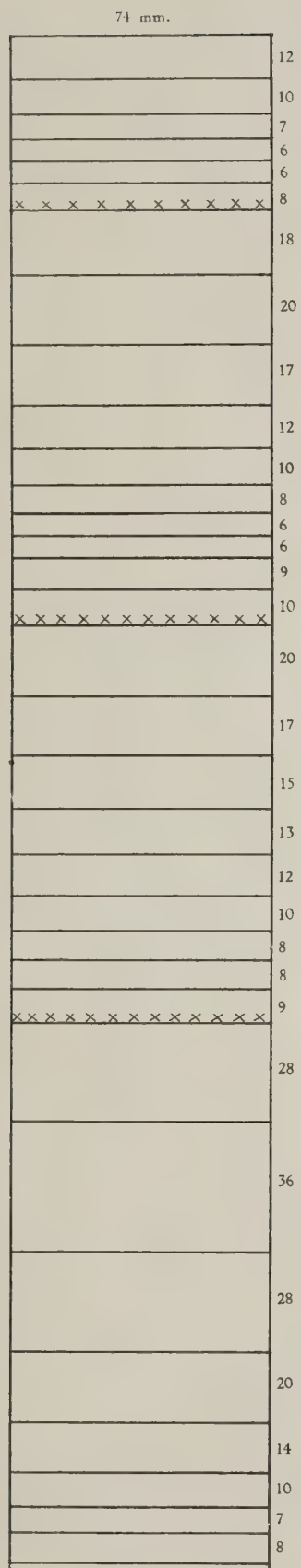
They are however divisible into three groups.

I. CALAMITES SCHÜTZEIFORMIS KIDSTON et JONGMANS.

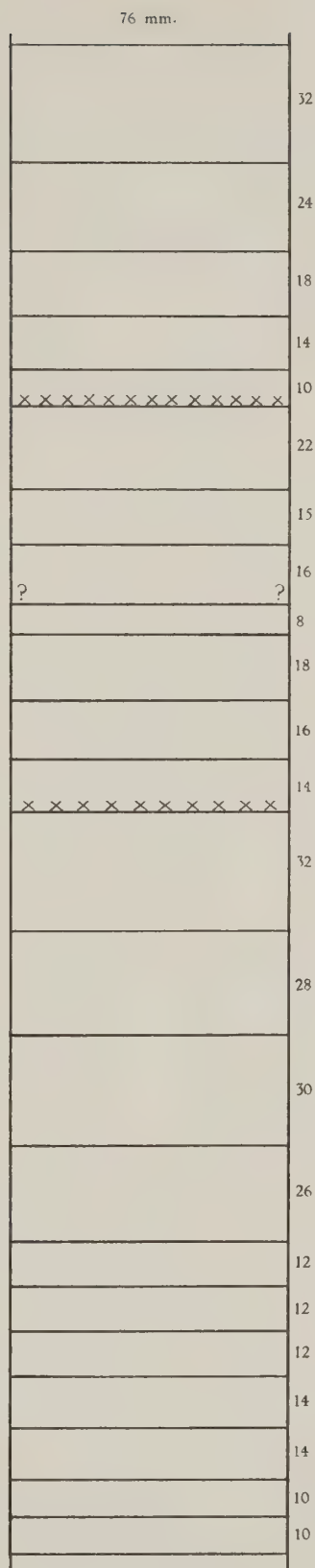
FORMA TYPICUS.

Pl. 68, fig. 1; Pl. 71, fig. 3; Pl. 73, fig. 5; Pl. 74, fig. 1; Pl. 75, fig. 1, 2; Pl. 79, fig. 1, 2; Pl. 80, fig. 1, 2; Text fig. 52—57.

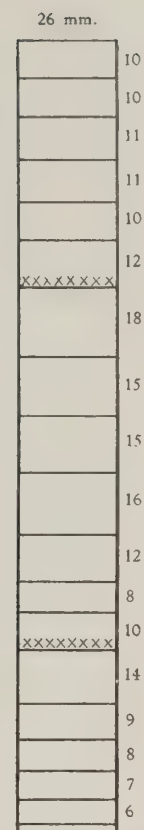
- 1913 *Calamites schützeiformis* KIDSTON and JONGMANS, forma typicus KIDSTON and JONGMANS in JONGMANS and KUKUK, Calam. Rhein. Westf. Kohlenb., p. 32, Text fig. 2.
- 1825 *Calamites approximatus* ARTIS, Antediluv. Phytology, Pl. 4.
- 1828 *Calamites approximatus* BGT., (pars), Histoire, I, p. 133, Pl. 15, fig. 7, 8.
- 1833 *Calamites approximatus* L. and H., Fossil Flora, I, p. 213, Pl. 77.
- 1850 *Calamites approximatus* MANTELL, Pictorial Atlas, Pl. 16.
- 1884 *Calamites approximatus* LESQUEREUX, 13th Ann. Rept. Indiana Dept. of Geology and Nat. Hist., II, p. 40, Pl. 5, fig. 6.
- 1825 *Calamites ornatus* STERNBERG, Versuch, I, 4, Tentamen, p. XXVII; Versuch, II, 5, 6, 1833, p. 50.
- 1879-80 *Calamodendron species* LESQUEREUX, Coal Flora, I, p. 32, Pl. 75, fig. 16.
- 1881 *Calamites alternans* STUR, Zur Morphol. der Calam., p. 417, Pl. 1, fig. 2.
- 1884 *Calamites varians* cf. *schützei* WEISS, (pars), Steink. Calam., II, p. 79, Pl. 21, fig. 5.
- 1884 *Calamites varians* cf. *inconstans* WEISS, Steink. Calam., II, p. 79, Pl. 28, fig. 4.
- 1886 *Calamites (Calamodendron) schützei* ZEILLER, Valenciennes, Pl. 55, fig. 4; Text, 1888, p. 350.
- 1910 *Calamites schützei* HORWOOD, (pars), Journ. Linn. Soc., Bot., XXXIX, Pl. 18.
- 1911 *Calamites schützei* JONGMANS, (pars), Anleitung, I, p. 92, fig. 90, 91.
- 1893 *Calamites varians* RENAULT, Autun et Épinac, Pl. 54, fig. 9.
- 1893 ? *Arthropitys medullata* RENAULT, Autun et Épinac, II, p. 107, Pl. 54, fig. 7, 8.
- 1911 ? *Calamites (Arthropitys) medullatus* JONGMANS, Anleitung, I, p. 98, fig. 96.



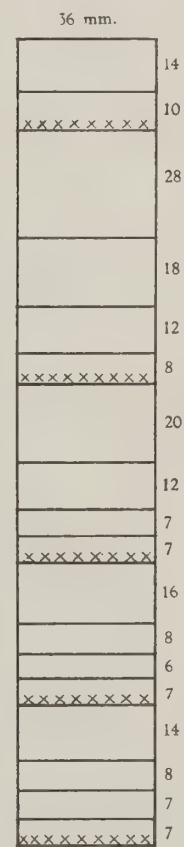
Text fig. 52.
Diagram of the specimen
shown on Pl. 75, fig. 1, 2.



Text fig. 53.
Diagram of the specimen
shown on Pl. 80, fig. 1, 2.



Text fig. 54.
Diagram of the specimen
shown on Pl. 79, fig. 2.



Text fig. 55.
Diagram of the specimen
shown on Pl. 79, fig. 1.

DESCRIPTION.

Internodes of unequal length, varying from 0,75 cm. to 9 cm. Shortest nodes immediately above the branch verticils and longest almost invariably immediately beneath it.

Verticils separated by periods of 4 to 9 internodes.

Ribs prominent, of medium width.

REMARKS.

A characteristic specimen of *C. schützeiformis forma typicus* is given on Pl. 75, fig. 1, 2. Fig. 1 fits on to the top of fig. 2. It shows three branch scar verticils but owing to the preservation of the stem these are not so distinctly seen as on the other side of the specimen given at fig. 1, Pl. 74. This is the surface on which the fossil has evidently been lying and the ribs are flattened and not very distinctly seen but it shows more clearly than the other side the position of the branch verticils.

The internode at the base of the period on which the branch scars sit, as well as the two or three succeeding ones, are of almost equal length, but above them the internodes gradually increase in length until they meet the next verticil of branch scars. (Text fig. 52). In rare cases the internode immediately below the branch whorl may be slightly shorter than the one below it, but as a rule it is the longest in the period and when it is not, the difference between it and the longer one is very slight, although in the lowest period of this specimen there is the exceptional difference of 8 mm.

On Pl. 80, figs. 1, 2, another specimen is seen. Fig. 1 fits on to the top of fig. 2. Two branch whorls are seen here and beneath them the longest internodes in the periods are found.

A curious irregularity occurs in the complete interval of this specimen by what appears to be a very short internode interpolated between two longer ones, but the nodal line separating these two short internodes can only be traced partly across the cast. This is indicated on our diagram in Text fig. 53, where the node referred to is distinguished by two interrogation marks.

At the tops of many internodes the ribs show indications of their terminal tubercle.

Another cast on which however the ribbing is somewhat obscured by a thin envelope of coal, is given on Pl. 79, fig. 2 and in Textfig. 54. The ribbing is best seen on the three internodes at the base of the specimen, which has been unfortunately placed on our plate in inverted position but the diagram shows its correct orientation. Although the internodes in the complete verticil show that in some cases a succeeding internode is shorter than that which lies below it, the greatest difference does not here exceed 2 mm. The portions of the two other periods preserved show a regular progressive increase in the length of their internodes.

The specimen given on Pl. 79, fig. 1, of which a diagram is seen at Text fig. 55, has four complete periods, each of which consists of four internodes. In all cases here the longest internode is immediately below the branch whorl and with one exception the shortest immediately above it. This specimen illustrates very clearly the characters

which we regard to be distinctive of the *forma typicus*, as far as the periods are concerned but the ribbing is shown very imperfectly.

A small fragment given on Pl. 71, fig. 3, shows a frequent mode of preservation of *C. schützeiformis typicus*, the cast being covered with a thin layer of coal. It possesses one whorl of branch scars and a few of the ribs can be seen on the two internodes above it.

A termination of the *forma typicus* is seen on Pl. 73, fig. 5. Although one cannot here distinguish periods separated by whorls of branch scars nevertheless the termination seems to show a

periodical arrangement of the internodes, perhaps in this case associated with the development of roots.

Part of a pith cast with very long internodes is given on Pl. 68, fig. 1. This is most probably a fragment of *forma typicus* as it possesses the usual characters of such pith casts in its constricted

nodes and the form of the ribbing, though it is too fragmentary to speak with certainty on its identification.

At Text fig. 56 is reproduced the figure given by ZEILLER under the name of *C. schützei* and at Text fig. 57 a copy of a figure published by WEISS which has been referred by him to *C. varians cf. schützei*. Both these we place under *C. schützeiformis forma typicus*.

Although it is impossible to determine the true species to which the casts included here belong, from the relationship of the internodes to each other and their lengths in connection with the branch whorl, some of them, especially those which do not show a strong convergence of ribs to the scars, are quite possibly the pith casts of *C. sachsei*.



Fig. 57

Calamites schützeiformis typicus
copied from WEISS. (*C. varians*
cf. schützei).

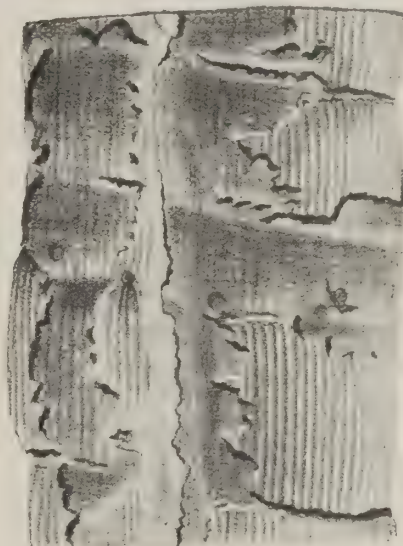


Fig. 56

Calamites schützeiformis typicus
copied from ZEILLER. (*C. schützei*).

DISTRIBUTION.

Great Britain.

Radstockian Series (Upper Coal Measures).

Horizon: Radstock Group.

Locality: Camerton, Somerset. (Collection KIDSTON, No. 334).

Staffordian Series.

Horizon: No. 2 Rhondda Seam.

Locality: Cambrian Collieries, Clydach Vale, Rhondda. (South Wales). Collected by D. DAVIES.

Westphalian Series.

Horizon: Haigh Moor Rock.

Locality: South Kirkby near Pontefract, Yorkshire. Collected by W. GELDER. (Collection KIDSTON, No. 3773).

Horizon: Barnsley Thick Coal.

Locality: Woolley Colliery, Darton near Barnsley, Yorkshire. Collected by W. HEMINGWAY. (Collection KIDSTON, No. 1287).

Netherlands.

Westphalian Series.

Horizon: Seam V. (Pl. 80, fig. 1, 2). Seam VI. (Pl. 71, fig. 3; Pl. 73, fig. 5; Pl. 79, fig. 1, 2).

Locality: Wilhelmina Colliery, near Heerlen, Limburg.

Belgium.

Westphalian Series.

Locality: Trazegnies. (Musée Hist. Nat. Bruxelles, Nos. 3940, 3946).

France.

Westphalian Series.

Pas de Calais Coalfield.

Horizon: Seam Marie.

Locality: Marles Collieries, Pit Sainte Abel. (*C. schützei* ZEILLER's Pl. 55, fig. 4).

Autun Coalfield.

(*C. medullatus* RENAULT, Pl. 54, fig. 7, 8).

(*C. varians* RENAULT, Pl. 54, fig. 9).

Germany.

Westphalian Series.

Aachen=Basin.

Horizon: Seam Gross-Meister.

Locality: Gouley Colliery. (Pl. 68, fig. 1). (Rijks Opsporing van Delfstoffen).

Rheno=Westphalian Basin.

Horizon: Fettkohle.

Localities: Siebenplaneten Colliery near Langendreer. (WEISS, Calam., II, Pl. 21, fig. 5).

Preussen Colliery near Lünen. (Collection Berggewerkschaftskasse, Bochum).

Horizon: Magerkohle.

Locality: Crone Colliery near Hörde. (WEISS, Calam., II, Pl. 28, fig. 4).

Saar-Basin.

Horizon:?

Locality: Colliery v. d. Heydt. (Pl. 74, fig. 1; Pl. 75, fig. 1, 2). (Geolog. Institute, Halle).

Silesia.

Horizon: Hangendzug, Lower Silesia.

Locality: Melchior Colliery near Dittersbach. (Geol. Landesanstalt, Berlin).

Russia.

Horizon: ?

Locality: Petrowskaja near Charkow, Central Russia. (Geol. Museum, München).

United States America.

Localities: Pennsylvania, Cannelton. (LESQUEREUX, 1879, Pl. 75, fig. 16).

Indiana. (LESQUEREUX, 1884, Pl. 5, fig. 6).

II. CALAMITES SCHÜTZEIFORMIS KIDSTON et JONGMANS. FORMA INTERMEDIUS.

Pl. 68, fig. 2; Pl. 73, fig. 1, 2; Pl. 76, fig. 3. Text fig. 58—61.

1881 ? *Calamites cf. approximatus* STUR, Zur Morphologie der Calamarien, p. 458, fig. 13, 14.

1887 ? *Calamites cf. approximatus* STUR, Calam. schatzl. Schichten, p. 37, Text fig. 16, 17.

1888 ? *Calamites cf. approximatus* TOULA, (pars), Die Steinkohlen, p. 202, Pl. 5, fig. 6.

1887 *Calamites approximatus* STUR, (pars), Calam. schatzl. Schichten, p. 119, Pl. 5, fig. 2.

1888 *Calamites approximatus* RENAULT, (pars), Commentry, Pl. 53, fig. 1; Text, 1890, p. 434.

1908 *Calamites approximatus* RENIER, Méthodes, p. 41, fig. 15.

1910 *Calamites approximatus* ARBER, Fossil Flora Yorkshire, Proc. of the Yorksh. Geol. Soc., XVII, 2, p. 144, Pl. 13, fig. 3.

1897 *Calamites typ. approximatus* POTONIÉ, Lehrbuch, p. 191, fig. 187.

1896 ? *Arthropitys approximatus* RENAULT, Notice sur les Calamariacées, II, Bull. Soc. hist. nat. Autun, IX, p. 307, Pl. 1, fig. 1, 2, 3. (Figures reduced).

1884 *Calamites varians cf. schützei* WEISS, (pars), Steinkohlen Calamarien, II, p. 80, Pl. 27, fig. 2.

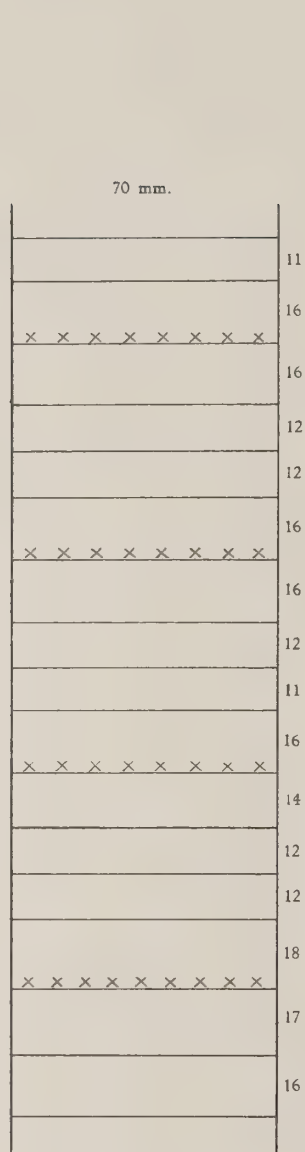
1911 *Calamites varians* JONGMANS, Anleitung, I, p. 74, fig. 73.

1912 *Calamites varians* ARBER, Forest of Dean, Phil. Trans. Roy. Soc. London B, CCII, p. 240, Pl. 13, fig. 15, (non fig. 16). (Reduced figure of JONGMANS, 1911).

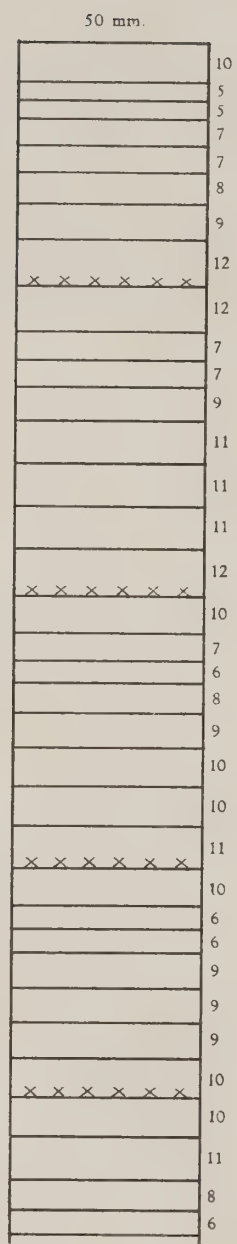
1911 *Calamites schützei* JONGMANS, (pars), Anleitung, I, p. 94, fig. 92.

DESCRIPTION.

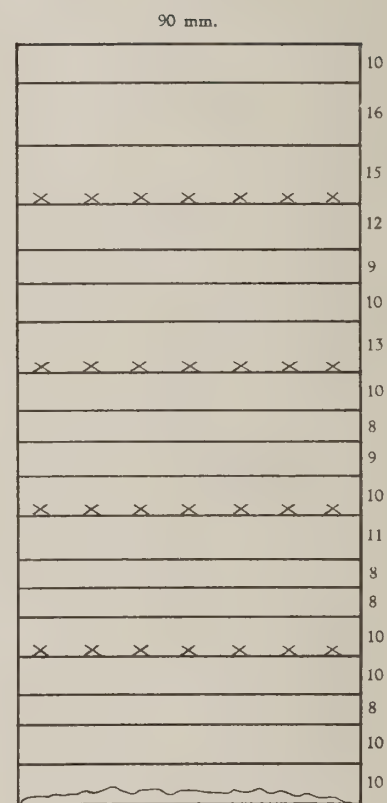
Internodes varying from 4 mm. to 1,7 cm. in length. The two longest internodes in a period are the one immediately above and the other immediately below the branch whorls.



Text fig. 58.
Diagram of the specimen
shown on Pl. 76, fig. 3.



Text fig. 59.
Diagram of the specimen
shown on Pl. 73, fig. 1, 2.



Text fig. 60.
Diagram of the specimen
shown on Pl. 68, fig. 2.

Diagrams of Pith Casts of
CALAMITES SCHÜTZEIFORMIS K. et J. FORMA INTERMEDIUS.

REMARKS.

A typical example of the *forma intermedius* is shown on Pl. 76, fig. 3 and a diagram in Text fig. 58. The outstanding character by which *forma intermedius* is distinguished from *formae typicus* and *waldenburgensis* is the occurrence of the two longest internodes in a period immediately above and below the branch whorl and this is brought out with great distinctness in this specimen. It also shows the strong ribs, converging towards the branch scars.

Pl. 73, fig. 1, 2 represent two portions of the same fossil, fig. 1 fitting on to the top of fig. 2. Here again we find that the internodes immediately above and beneath the branch scar verticil are the longest in the period. A diagram of this specimen is shown at Text fig. 59. Three complete periods are shown and portions of two others. Of the complete periods, two consist of eight internodes and one of seven.

Another specimen showing four branch verticils is given on Pl. 68, fig. 2, of which a diagram is given at Text fig 60. The three complete periods each consist of four internodes whose relative lengths are similar to those already described.

The same character of the longest internodes being at the top and the bottom of the periods is again seen in the specimen given at Text fig. 61. Here there is a slight variation in so far that the internode at the top of the period is longer than that at the bottom and in the centre of the period several of the internodes are of the same length as that occurring immediately above the branch whorl.



Fig. 61

Calamites schützeiformis intermedius.
2nd Division Coal, Trafalgar Colliery,
Forest of Dean, Gloucestershire.
(Photo by Dr. ARBER).

DISTRIBUTION.

Great Britain.

Upper Coal Measures.

Horizon: 2nd Division of Coal Series.

Locality: Trafalgar Colliery, Forest of Dean, Gloucestershire. (No. 1464, Sedgwick Museum, Cambridge; JONGMANS, 1911, fig. 73; ARBER, 1912, Pl. 13, fig. 15). (Our Text fig. 61).

Westphalian Series.

Horizon: Top Hard Coal.

Locality: Brindsley Clay Pit, Kimberley, Nottinghamshire. (ARBER, 1910, Pl. 13, fig. 3).

Netherlands.

Westphalian Series.

Horizon: Seam VI.

Locality: Wilhelmina Colliery, near Heerlen, Limburg. (Pl. 68, fig. 2).

Belgium.

Westphalian Series.

Horizon: ?

Locality: Sondage de Lanklaer No. 20. (RENIER, Méthodes, fig. 15).

France.

? St. Etienne. (STUR, 1881, Text fig. 13, 14; 1887, Textfig. 16, 17).

Stephanian Series.

Commentry Coalfield.

Horizon: 6 M. over the roof of the „Grande Couche.”

Locality: Western Trench. (RENAULT's Pl. 53, fig. 2).

Germany.

Westphalian Series.

Silesia.

Horizon: Schatzlarer Schichten.

Localities: Waldenburg. (Coll. Bergschule Waldenburg, No. 748). (STUR's Pl. 5, fig. 2).

Friedenshoffnungs Colliery near Hermsdorf, Lower Silesia. (Pl. 76, fig. 3).
(Original WEISS, 1884, Pl. 27, fig. 2). (Geol. Landesanstalt, Berlin).

Hermsdorf Collieries, Lower Silesia. (Geol. Landesanstalt, Berlin).

Saar-Basin.

Horizon: ?

Locality: Itzenplitz Colliery near Saarbrücken. (Pl. 73, fig. 1, 2). (Geol. Landesanstalt, Berlin).

III. CALAMITES SCHÜTZEIFORMIS KIDSTON et JONGMANS.

FORMA WALDENBURGENSIS KIDSTON pro spec.

Pl. 71, fig. 4, 5; Pl. 72; Pl. 73, fig. 3, 4; Pl. 74, fig. 2, 3; Pl. 77, fig. 1, 2; Pl. 78, fig. 1, 3;
Pl. 79, fig. 3, 4. Text fig. 62—66.

- 1913 *Calamites schützeiformis forma waldenburgensis* JONGMANS and KUKUK, Calam. Rhein. Westf. Steink., Meded. Rijks Herbarium, Leiden, 20, p. 32, Text fig. 1.
1903 *Calamites waldenburgensis* STUR, (pars), KIDSTON, Canonbie, Trans. Roy. Soc. Edinburgh, XL, p. 788.
1911 *Calamites waldenburgensis* JONGMANS, Anleitung, I, p. 57, fig. 65, 66.
1914 *Calamites waldenburgensis* KIDSTON, Staffordshire, Trans. Roy. Soc. Edinburgh, L, p. 118.
1887 *Calamites approximatus (waldenburgensis)* STUR, (pars), Calam. schatzl. Schicht., p. 119, Pl. 5, fig. 3; Pl. 8, fig. 4, (non Pl. 5, fig. 2).
1828 *Calamites approximatus* BGT., (pars), Histoire, p. 133, Pl. 24, fig. 2—4, (non fig. 5, non Pl. 15, fig. 7, 8).
1855 *Calamites approximatus* GEINITZ, (pars), Sachsen, p. 7, Pl. 11, fig. 5; Pl. 12, fig. 3.
1869 *Calamites approximatus* SCHIMPER, (pars), Traité, I, Pl. 19, fig. 2, 3.
1876 *Calamites approximatus* ROEMER, Lethaea palaeozoica, Atlas, Pl. 50, fig. 3.
1884 *Calamites approximatus* WEISS, Calamarien, II, p. 81, Pl. 25, fig. 1.
1893 *Calamitina approximata* KIDSTON, Kilmarnock etc., Trans. Roy. Soc. Edinburgh, XXXVII, p. 311, Pl. 2, fig. 5. 6.
1898 *Calamites approximatus* SEWARD, Fossil Plants, I, p. 370, fig. 100.
1899 *Calamites approximatus* HOFMANN and RYBA, Leitpflanzen, p. 24, Pl. 1, fig. 5.
1901 *Calamitina approximata* KIDSTON, Flora Carb. Period, Proc. Yorksh. Geol. and Polytech. Soc., XIV, p. 225, Pl. 35, fig. 2.
1903 *Calamites approximatus* ARBER, Q. J. G. S. London, LIX, Pl. 1, fig. 3.
1909 *Calamites approximatus* ARBER, Fossil Plants, p. 74, Pl. on p. 53.
1911 *Calamites approximatus* KIDSTON, Hainaut, Mém. Mus. Roy. Hist. Nat. Belgique, IV, p. 100.
1888—1890 *Arthropitys approximata* RENAULT, Commentry, II, p. 434, Pl. 52, fig. 6, (non Pl. 53, fig. 1).
1896 *Arthropitys approximata* RENAULT, Notice sur les Calamar., II, Bull. Soc. Hist. Nat. Autun, IX, p. 307, Pl. 1, fig. 10, (non fig. 1—9).

DESCRIPTION.

Internodes all short from 0,30 cm. to 1,50 cm. long. Longest internode immediately below the branch whorl.

Pith cast attaining a width of 18 cm. or more. Internodes more or less convex with much constricted nodes.

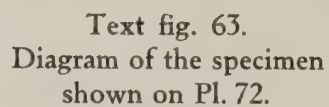
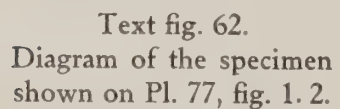
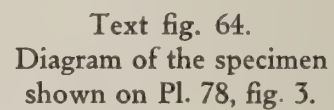
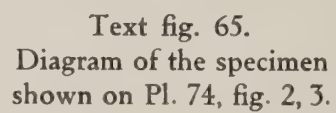
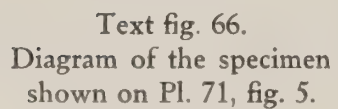
Branch whorls periodic, separated by 5 to 18 or more internodes.

Ribs very prominent, strongly converging towards the branch scars.

Pith cast frequently bordered by a wide band representing the impression of the wood.

REMARKS.

Our longest example of this form is given on Pl. 77, fig. 1, 2. Fig. 1 fits on to the top of fig. 2. A diagram of this specimen is seen at Text fig. 62. It shows seven complete periods. The internode above the branch whorl is always shorter than that immediately



Diagrams of Pith Casts of
CALAMITES SCHÜTZEIFORMIS K. et J. FORMA WALDENBURGENSIS.

below it, although the internode above that which bears the branch whorl is generally slightly smaller.

The widest pith cast of *C. schützeiformis forma waldenburgensis* with which we have met, is that given on Pl. 72. The internodes are remarkably short compared with the width of the cast and of almost equal length except those associated with the branch whorls, below which the longest internode of the period occurs. The relative length of the internodes and their position in the periods is shown in the diagram given at Text fig. 63.

Another very long specimen, 34 cm. in length, is given on Pl. 79, figs. 3—4, fig. 3 fitting on to the top of fig. 4. It consists of 53 internodes of about 7 mm. each in height. This specimen does not seem to have possessed a single branch whorl, nor is there any clear evidence of isolated branches having been borne on this portion of the plant. Otherwise the short internodes with their strong ribbing correspond well in their general characters with those of *forma waldenburgensis*.

A somewhat similar specimen showing 32 internodes is given at fig. 1, Pl. 78. The internodes are of almost equal length being from 5 to 7 mm. long. There are no branch verticils but on five of the nodes a single branch scar is present but they are very irregularly placed in relation to each other. The internodes are very convex as seen in their profile at the margin of the figure.

Fig. 3, Pl. 78 shows another pith cast of this form, a diagram of which is seen at Text fig. 64. This only possesses one branch whorl, with a small internode above it and a large one underneath it. The ribbing is very prominent and the internodes are convex.

A pith cast of similar type is seen on Pl. 74, fig. 2, of which a diagram is given at Text fig. 65. It possesses three branch whorls and two complete periods, consisting of seven and eight internodes respectively. This example also shows well the prominent ribs converging towards the branch scars and the convex contour of the internodes. A small part of the outer surface is enlarged at fig. 3 of the same plate. It is smooth with longitudinal ridges or cracks, and shows the large, somewhat distant, subcircular leaf scars.

Another specimen is given on Pl. 71, fig. 5, with one branch whorl, above which are fifteen internodes without the occurrence of a second branch whorl. A diagram of this specimen is represented at Text fig. 66.

A little pith cast with very short internodes and very strong ribs is given on Pl. 71, fig. 4. The internodes here vary in width from 3 to 5 mm. The specimen which consists of 19 internodes shows no branch scars.

Two peculiar specimens of *forma waldenburgensis* are given on Pl. 73. That seen at fig. 4 is remarkable for the wideness of its ribs, which on an internode 5 mm. long, are over two mm. wide.

The other specimen given at fig. 3 shows a curious abnormality. In the branch whorl towards the centre of the figure a large scar is seen towards the left hand side. The node which bears this scar bends upward and seems to coalesce with the nodal line above it. The remainder of the branch whorl occurs on the node below that bearing the single scar. Otherwise the specimen is quite typical of the *forma waldenburgensis*.

Some of the forms included under the name of *C. schützeiformis forma waldenburgensis* may be the pith cast of *C. goepperti*. ¹⁾

DISTRIBUTION.

Great Britain.

Radstockian Series.

Horizon: Radstock Group.

Locality: Tyning Pit, Radstock, Somerset. Collected by T. STOCK. (Pl. 73, fig. 3).

Horizon: Graigole Seam.

Locality: Level, nearly $\frac{3}{4}$ m. S. W. of Glyn-coch Farm, Cwm Clydach, Glamorgan. (South Wales). (Collection Geological Survey, London).

Staffordian Series.

Horizon: Sandstones under Mynyddislwyn Seam.

Locality: Bute Quarry, Pwllypant near Caerphilly. (South Wales).

Horizon: Troedyrhywclawdd Coal. (No. 2 Rhondda).

Locality: Victoria Ironworks, Monmouthshire. (South Wales).

Horizon: Blanck Band Group.

Locality: Tunnel, Newcastle-under-Lyme; North Staffordshire.

Westphalian Series.

Horizon: Woolley Edge Rock.

Locality: Smithies near Barnsley, Yorkshire. Collected by W. HEMINGWAY. (Collection KIDSTON, No. 4486).

Horizon: Upper Chevet Rock.

Locality: Darfield near Barnsley, Yorkshire.

Horizon: Ten Foot Ironstone Measures.

Locality: Cabbage Hall Pit, Netherton near Dudley, South Staffordshire. Collected by H. W. HUGHES. (Collection KIDSTON, No. 4701).

Horizon: Immediately below Bottom Coal.

Locality: Ruiton near Sedgley, South Staffordshire.

Horizon: Roof of Fire Clay Coal.

Locality: Netherton, South Staffordshire.

Horizon: Roof of Peacock Coal.

Locality: Bardsley Colliery, Ashton under Line, Lancashire.

Horizon: Blendfire Rock.

Locality: Oldham Edge, Oldham, Lancashire.

¹⁾ The specimen figured by WEISS, Calamarien, II, Pl. 28, fig. 2 under the name of *Calamites varians inversus* is very imperfectly preserved. It is represented on our Pl. 55, fig. 5. The ribbing is very indistinctly shown and the specimen does not possess sufficiently well defined characters to enable one to determine its systematic position.

Horizon: Ravenhead Coal.

Locality: Ravenhead, St. Helens, Lancashire. (Liverpool Museum).

Horizon: Above Bradford Four Feet Coal.

Locality: New Sinking, Bradford Colliery, Manchester.

Horizon: Low Main Coal.

Locality: Cramlington, Northumberland.

Horizon: Red Seam.

Locality: Cambrian Collieries, Clydach Vale, Rhondda. (South Wales). (Collected by D. DAVIES).

Horizon: Between Top Hard and Deep Soft Coals.

Locality: Newthorp Clay Pit, Eastwood, Nottinghamshire. (Collection Dr. L. MOYSEY; Pl. 78, fig. 3).

Horizon: Great Row Coal Rock.

Locality: Fenton, North Staffordshire.

Lanarkian Series.

Horizon: Five quarter Coal. (Darroch Coal).

Locality: Stevenston; Ayrshire. (Pl. 71, fig. 4).

Horizon: About 18 feet above Darroch Coal.

Locality: Woodhill Quarry, Kilmaurs, Ayrshire. (Pl. 71, fig. 5).

Horizon: Shale over Major Coal.

Locality: Hillhead Pit, Kilmarnock, Ayrshire.

Belgium.

Westphalian Series.

Horizon: Seam du Parc.

Localities: Mariemont Collieries, Pit Réunion. (Pl. 73, fig. 4; Coll. DELTENRE, No. 1325).
Jemappes Collieries (KIDSTON, 1911, Mus. Roy. Hist. Nat., Bruxelles, No. 2207).

France.

Stephanian Series.

Horizon: Shales intercalated in the second seam.

Locality: Commentry, Western Trench. (RENAULT, Commentry, Pl. 52, fig. 6).

Germany.

Westphalian Series:

Saar=Basin.

Horizon: Seam Aster.

Locality: Dechen Colliery. (WEISS, Calam., II, Pl. 25, fig. 1; refigured on our Pl. 77, fig. 1, 2). (Geol. Landesanstalt, Berlin).

Horizon: Seam Thiele.

Locality: Heinitz Colliery, 4. Tiefbausohle. (Geol. Landesanstalt, Berlin).

Horizon: Seam 8.

Locality: Dudweiler Colliery near Saarbrücken. (Pl. 74, fig. 2. 3). (Geol. Landesanstalt, Berlin).

Saxony.

Horizon: ?

Localities: Oberhohndorf near Zwickau. (K. k. Hofmuseum, Wien; Zwinger Museum, Dresden; GEINITZ, Pl. 11, fig. 5).

Niedercainsdorf(?) in Sachsen. (ROEMER's Pl. 50, fig. 3).

Bockwa near Niedercainsdorf. (GEINITZ, Pl. 12, fig. 3).

Segen Gottes Pit near Lugau. (Pl. 72). (Zwinger Museum, Dresden).

Horizon: Grund Seam.

Locality: Lugau, Carl Pit. (Pl. 78, fig. 1; Pl. 79, fig. 3, 4). (Naturw. Samml. der Stadt Chemnitz).

Silesia.

Horizon: Schatzlarer Schichten.

Locality: Glückhelf Colliery, Hermsdorf near Waldenburg. (Collection Bergschule Waldenburg, No. 4273, 4274; STUR's Pl. 5, fig. 3; Pl. 8, fig. 4).

Bohemia.

Westphalian Series.

Locality: Lubna near Rakonitz. (HOFMANN and RYBA's Pl. 1, fig. 5).

CALAMITES DELTENREI KIDSTON et JONGMANS n. sp.

Pl. 69, fig. 1.

DESCRIPTION.

Pith cast ribbed, preserved only as an impression. Ribs longitudinally striated with very faint indications of cross-hatching. Terminations of ribs indistinct. Cast constricted at the nodes. Alternate nodes bear small circular scars, irregularly placed immediately above the nodal line, to which the ribs feebly converge. They occur on the various nodes in unequal number. Tubercles oval, very small, indistinct. Outer surface unknown.

REMARKS.

The specimen which forms the type of this species is contained in the collection of M. H. DELTENRE, Morlanwelz, who has kindly placed it in our hands for description. It is the only example we have seen of this species, which we have pleasure in naming after M. DELTENRE, whose investigations at Mariemont have contributed much to our knowledge of the Carboniferous flora.

It is impossible to refer this specimen to any of the ordinary Calamitic groups, though it shows certain affinities with some of these. The small scars remind one somewhat

of the scars of *C. cruciatus* but are smaller and have a less distinct convergence of the ribs towards them and also they only occur on every alternate node.

From the *C. sachsei*-group it differs not only in the short periodic occurrence of the scars but also in their small size and their irregular distribution on the nodes and further the delicate cross-hatching of the ribs has not been observed in *C. sachsei* as far as we at present know, but it is so delicate, that it could only be observed on exceptionally well preserved specimens.

A figure of the specimen is given on Plate 69, fig. 1.

The variation in the number of branch scars is as follows:

1st. node:	no scars on exposed surface				
2nd. „	3	„	„	„	„
3rd. „	no	„	„	„	„
4th. „	2	„	„	„	„
5th. „	no	„	„	„	„
6th. „	3	„	„	„	„
7th. „	no	„	„	„	„
8th. „	4	„	„	„	„
9th. „	no	„	„	„	„
10th. „	4?	„	„	„	„
11th. „	no	„	„	„	„
12th. „	5	„	„	„	„
13th. „	no	„	„	„	„
14th. „	4?	„	„	„	„
15th. „	no (incomplete)				

DISTRIBUTION.¹⁾

Belgium.

Westphalian Series.

Horizon: Seam Olive.

Locality: Mariemont Collieries, Pit Ste. Henriette. (Pl. 69, fig. 1).

CALAMITES SUCKOWI BRONGNIART.

Pl. 39, fig. 2, 3; Pl. 82—87; Pl. 88, fig. 2, 3; Pl. 89; Pl. 90, fig. 2; Pl. 136, fig. 2, 3;

Pl. 137, fig. 1, 2; Pl. 138, fig. 1; Text fig. 67.

1828 *Calamites suckowi* BGT., (pars), Histoire, I, p. 124, Pl. 15, fig. 5, 6; Pl. 16, fig. 2, (non Pl. 14, fig. 6; Pl. 15, fig. 1; Pl. 16, fig. 1).

1828 *Calamites suckowi* BGT., Prodrome, p. 37, 167.

1833 *Calamites suckowi* STERNBERG, Versuch, II, Fasc. 5, 6, p. 49.

1835 *Calamites suckowi* GUTBIER, Zwickau, p. 17, Pl. 2, fig. 1, (non fig. 2).

¹⁾ A similar specimen has recently been found in the Netherlands: Boring Swalmen (21), at a depth of 869 m.

- 1837 *Calamites suckowi* BRONN, Lethaea geogn., I, 2, p. 18, Pl. 6, fig. 1a, b.
- 1841 *Calamites suckowi* PETZOLDT, Ueber Calamites und Steinkohlenbildung, p. 67, Pl. 6, fig. 9.
- 1843 *Calamites suckowi* GUTBIER, Gaea v. Sachsen, p. 67.
- 1845 *Calamites suckowi* UNGER, Synopsis, p. 21.
- 1848 *Calamites suckowi* GOEPPERT, in Bronn, Index palaeont., p. 199.
- 1848 *Calamites suckowi* SAUVEUR, Belgique, Pl. 3; Pl. 4, fig. 1, 2; Pl. 11, fig. 3.
- 1850 *Calamites suckowi* UNGER, Gen. and spec., p. 44.
- 1850 *Calamites suckowi* MANTELL, Pictorial Atlas, p. 47, Pl. 6, fig. 1, 2.
- 1852-54 *Calamites suckowi* BRONN, Leth. geogn., 3. Aufl., p. 101, Pl. 6, fig. 1a, b.
- 1855 ? *Calamites suckowi* SCHMIDT, Petrefactenbuch, Pl. 1, fig. 4.
- 1855 *Calamites suckowi* GEINITZ, (pars), Sachsen, p. 6, Pl. 13, fig. 1, 2, 3, 5, 6, (non fig. 4).
- 1865 *Calamites suckowi* HEER, Urwelt der Schweiz, p. 8, 9, fig. 5a, (non fig. 5b).
- 1868 *Calamites suckowi* DAWSON, Acad. Geol., 2. Ed., p. 195, (? fig. 39; p. 442, fig. 163 A₂, A₄; p. 478) (non fig. 163 A, A₁, A₃).
- 1868 *Calamites suckowi* ROEHL, Westfalen, Palaeontographica, p. 9, Pl. 1, fig. 6, (? Pl. 2, fig. 2).
- 1869 *Calamites suckowi* SCHIMPER, Traité, I, p. 312, (non Pl. 18, fig. 1).
- 1870 *Calamites suckowi* WEISS, Foss. Fl. d. jüngst. Steink. u. Rothl., p. 117, Pl. 13, fig. 5.
- 1871 *Calamites suckowi* LYELL, Elements of Geology, p. 406, fig. 458.
- 1872 *Calamites suckowi* (with *Huttonia carinata*, non GERMAR), FEISTMANTEL, (pars), Fruchtstadien, Abh. k. Böhm. Ges. d. Wiss., Prag, (6), V, p. 11, Pl. 2.
- 1872 *Calamites suckowi* HEER, Le monde primitif, p. 9, fig. 5a, (non 5b).
- 1874 *Calamites suckowi* FEISTMANTEL, Studien, Abh. k. Böhm. Ges. d. Wiss., (6), VII, p. 170, Pl. 1, fig. 2.
- 1874 *Calamites suckowi* FEISTMANTEL, Böhmen, Palaeontographica, XXIII, p. 102, Pl. 2, fig. 3, 4; Pl. 3, fig. 1, 2; Pl. 4, fig. 1, 2; Pl. 5; Pl. 6, fig. 1.
- 1876 *Calamites suckowi* HEER, The primaeval world, I, p. 8, fig. 5a, (non 5b).
- 1876 *Calamites suckowi* WEISS, Steinkohlen Calam., I, p. 123, Pl. 19, fig. 1.
- 1876 *Calamites suckowi* ROEMER, Lethaea palaeoz., Atlas, Pl. 50, fig. 1.
- 1877 *Calamites suckowi* GRAND' EURY, Loire, p. 14, Pl. 1, fig. 1, 2, 3, (non fig. 4, 5, 6).
- 1878 *Calamites suckowi* ZEILLER, Explic. de la carte géol. de la France, IV, 2, Atlas, Pl. 159, fig. 1; Text, 1879, p. 12. (Separate 1880).
- 1878 *Calamites suckowi* DAWSON, Acad. Geology, 3. Ed., p. 195, (? fig. 39; p. 442, fig. 163, A₂, A₄), (non fig. A, A₁, A₃).
- 1879 *Calamites suckowi* HEER, Urwelt der Schweiz, 2. Aufl., p. 15, fig. 17a, (non 17b).
- 1879 *Calamites suckowi* LESQUEREUX, Coal flora, Atlas, Pl. 1, fig. 3, (non fig. 4); Text, I, 1880, p. 20.
- 1881 *Calamites suckowi* ACHEPOHL, Niederrh. Westf. Steink., p. 37, Pl. 10, fig. 1; p. 53, Pl. 14, fig. 16; (non Pl. 1, fig. 12; Pl. 16, fig. 5; Pl. 20, fig. 6; Pl. 21, fig. 3).
- 1881 *Calamites suckowi* WEISS, Aus d. Steink., p. 10, Pl. 7, fig. 43. (Also Ed. II, 1882).
- 1882 *Calamites suckowi* ACHEPOHL, l. c., Erg. Blatt I, fig. 9, (non fig. 16).
- 1882 *Calamites suckowi* RENAULT, Cours, II, p. 159, fig. 3, 5, (non fig. 4, 6).
- 1883 *Calamites suckowi* LAPPARENT, Géologie, p. 735, fig. 275.
- 1884 *Calamites* (*Stylocalamites*) *suckowi* WEISS, Steink. Calamarien, II, p. 129, Pl. 2, fig. 1; Pl. 3, fig. 2, 3; Pl. 4, fig. 1; Pl. 17, fig. 5; Pl. 27, fig. 3; (non Pl. 17, fig. 4, non Text fig. p. 135).
- 1886 *Calamites suckowi* ZEILLER, Valenciennes, Atlas, Pl. 54, fig. 2, 3; Pl. 55, fig. 1; Text, 1888, p. 333.
- 1887 *Calamites suckowi* STUR, Calam. schatzl. Schichten, p. 145, Pl. 3, fig. 3, 4; Pl. 5, fig. 5, 6; Pl. 16, fig. 1, 2; (? Pl. 1, fig. 3; non Pl. 9, fig. 2; non Pl. 14, fig. 1).
- 1888 *Calamites suckowi* DAWSON, Geol. Hist. of Plants, p. 123, (non fig. 46a), p. 124, ? fig. 49.
- 1888 *Calamites suckowi* RENAULT, Commentry, Pl. 43, fig. 1-3; Pl. 44, fig. 4, 5; Text, II, 1890, p. 385.
- 1888 *Calamites suckowi* TOULA, Die Steinkohlen, p. 202, Pl. 5, fig. 1, 2, 9, (non fig. 26, non Pl. 6, fig. 4).

- 1889 *Calamites suckowi* MILLER, North Amer. Geol. Pal., p. 110, fig. 20.
- 1889 *Calamites suckowi* SAPORTA, Rev. génér. bot., I, p. 584, Pl. 25, fig. 1, 1a, 1b.
- 1897 *Calamites suckowi* CREDNER, El. der Geologie, 8. Aufl., p. 458, fig. 252.
- 1899 ? *Calamites suckowi* POTONIÉ, Landschaft der Steinkohlenf., p. 27, fig. 17.
- 1899 *Calamites suckowi* HOFMANN and RYBA, Leitpflanzen, p. 24, Pl. 1, fig. 6.
- 1900 *Calamites suckowi* SCOTT, Studies, p. 15, fig. 2; p. 16, fig. 3.
- 1900 *Calamites suckowi* ZEILLER, Éléments, p. 149, fig. 106.
- 1901 *Calamites suckowi* STEFANI, Flora carb. et perm. della Toscana, p. 63, Pl. 10, fig. 3, 4.
- 1901 *Calamites suckowi* KIDSTON, Flora carb. period, Proc. Yorksh. Geol. and Polyt. Soc., XIV, pp. 200, 201, 202, 215, 225, Pl. 30, fig. 1; Pl. 35, fig. 3.
- 1903 *Calamites suckowi* FRITEL, Paléobotanique, p. 40, Pl. 6, fig. 3.
- 1906 *Calamites suckowi* MATTHEW, Little River Group, I, Trans. Roy. Soc. Canada, (2), XII, Sect. IV, p. 106, Pl. 1, fig. 4.
- 1906 *Calamites suckowi* ZEILLER, Blanzey et Creusot, p. 126, Pl. 37, fig. 1.
- 1906 *Calamites suckowi* LAPPARENT, Géologie, Ed. V, p. 887, fig. 386.
- 1907 *Calamites suckowi* STERZEL, (pars), Baden, Mitt. d. Grossh. Bad. Geol. Landesanst., V, 2, p. 429, Pl. 18, fig. 1, (non fig. 2); (non Pl. 19, fig. 1); p. 506, Pl. 31, fig. 2, (non Pl. 32, fig. 1); p. 702, Pl. 57, fig. 1 at A, (non fig. 2—5); Pl. 58, ? fig. 3, (non fig. 1, 2); (non Pl. 59, fig. 1).
- 1907 *Calamites suckowi* ZALESSKY, Donetz, I, Bull. Com. géol. St. Pétersbourg, XXVI, p. 363, fig. ? 2, (non fig. 1).
- 1907 *Calamites suckowi* ZALESSKY, Donetz, II, Bull. Com. géol. St. Pétersbourg, XXVI, p. 425, Pl. 21, fig. 2.
- 1907 *Calamites suckowi* ZALESSKY, Dombrowa, Mém. Com. géol., N. S., 33, pp. 16, 51, fig. 4.
- 1908 *Calamites suckowi* RENIER, Méthodes, p. 41, fig. 16.
- 1908 *Calamites suckowi* SCOTT, Studies, 2. Ed., pp. 17, 18, fig. 2, 3.
- 1910 *Calamites suckowi* RENIER, Docum. Paléont. terr. houill., p. 17, Pl. 43.
- 1911 *Calamites suckowi* JONGMANS, Anleitung, I, p. 164, fig. 137—139, 143, No. 5, (non fig. 140, 141, 142, 144).
- 1911 *Calamites suckowi* KIDSTON, Hainaut, Mém. Mus. Roy. Hist. nat. Bruxelles, IV, p. 113.
- 1912 *Calamites suckowi* GOTHAN, Palaeobotanik, Handwörterbuch der Naturwissensch., VII, p. 426, fig. 20, No. 1, 2.
- 1912 *Calamites suckowi* GOTHAN, Das Leben der Pflanze, VI, p. 53, fig. 44.
- 1913 *Calamites suckowi* JONGMANS and KUKUK, Calam., Mededeel. Rijks Herbarium, Leiden, No. 20, p. 19, Pl. 8, fig. 2, 3; Pl. 9, fig. 10.
- 1914 *Calamites suckowi* STOPES, Fern Ledges, Memoir 41, Geolog. Survey of Canada, p. 15, Pl. 2, fig. 2, (New figure of *C. cannaeformis* DAWSON, 1871).
- 1880 *Calamites suckowi et var. cannaeformis* ROTHPLETZ, Abh. d. schweiz. pal. Ges., VI (1879), p. 2, Pl. 2, fig. 1, 2.
- 1884 *Stylocalamites suckowi* WEISS, Steinkohlen Calam., II, Atlas, Explanation to Pl. 2, fig. 1; Pl. 3, fig. 2, 3; Pl. 17, fig. 5.
- 1887 *Stylocalamites suckowi* KIDSTON, Radstock, Trans. Roy. Soc. Edingburgh, XXXIII, 3, p. 342.
- Calamites suckowi var. canaliculatus* GOLDENBERG, mnsct. in Museum Stockholm.
- 1825 *Calamites decoratus* ARTIS, Antedil. Phytology, Pl. 24.
- 1828 *Calamites decoratus* BGT., (pars), Histoire, I, p. 123, Pl. 14, fig. 1, 2, (non fig. 3, 4).
- 1850 *Calamites decoratus* MANTELL, Pictorial Atlas, p. 51, Pl. 17.
- 1828 ? *Calamites cannaeformis* BGT., (pars), Histoire, I, Pl. 21, fig. 4.
- 1871 *Calamites cannaeformis* HIGGINS, Proc. Liverpool Nat. Field Club for 1870—71, p. 19, Pl. 1, fig. 2.
- 1871 *Calamites cannaeformis* DAWSON, Pl. Devon. and Upper Sil. Form. Geol. Surv. Canada, p. 26, Pl. 4, fig. 47, 48, (cf. *C. suckowi* STOPES, 1914).
- 1877 *Calamites cannaeformis* LEBOUR, Illustr., p. 1, Pl. 1.

- 1881 ? *Calamites cannaeformis* ACHEPOHL, Niederrh. Westf. Steink, p. 39, Pl. 11, fig. 1.
 1833 *Calamites aequalis* STERNBERG, (*pars*), Versuch, II, Fasc. 5, 6, p. 49.
 1848 *Calamites aequalis* GOEPPERT, (*pars*), in Bronn, Index pal., p. 198.
 1848 *Calamites artisii* SAUVEUR, Belgique, ? Pl. 7, fig. 1, 2, (*non* fig. 3, *non* Pl. 8, fig. 2).
 1848 *Calamites nodosus* SAUVEUR, Belgique, Pl. 12, fig. 3.
 1862 *Calamites communis* var. *suckowi* STUR, Jahresber. k.k. Geol. Reichsanst., Wien, XII, Sitzungsber., p. 141, 142.
 1874 *Calamites approximatus* FEISTMANTEL, Böhmen, p. 106, Pl. 6, fig. 2; Pl. 7, fig. 1, 2.
 1882 *Calamites irregularis* ACHEPOHL, Niederrh. Westf. Steink., p. 89, Pl. 28, fig. 2.
 1883 ? *Calamites rectangularis* ACHEPOHL, l.c., p. 130, Pl. 39, fig. 13.
 1784 *Calamites* SUCKOW, Acad. Elect. Theod. Palatinae, V, p. 355, Pl. 16, fig. 2; Pl. 18, fig. 10, (Rhizome); Pl. 19, fig. 8, 9, (? Pl. 18, fig. 11).
 1833 *Calamites species* L. and H., Fossil Flora, I, p. 215, Pl. 78.
 1833 *Calamites* (the base of a stem) L. and H., Fossil Flora, II, p. 39, Pl. 96.
 1871 ? *Calamites* DAWSON, Q. J. G. S. London, XXVII, Pl. 9, fig. 22.
 1878 *Calamites* WILLIAMSON, On the Organization, IX, Phil. Trans. Roy. Soc. London, Vol. CLXIX, Pl. 21, fig. 30.
 1881 ? *Calamites* SAPORTA ET MARION, Evolution, Cryptog., p. 138, fig. 56.
 1894 *Calamites* WILLIAMSON and SCOTT, Further Observations, I, Phil. Trans. Roy. Soc. London, Vol. CLXXXV, Pl. 86, fig. A, B, C, (? D,) E., F., G.
 1898 *Calamites* SEWARD, Fossil Plants, p. 323, fig. 82.
Calamites Volkmanni ETtingshausen mnsct. in Hofmuseum, Vienna.

DESCRIPTION.

Stem attaining a width of over 20 cm. Internodes 9,5 cm. or more long, generally broader than long, very rarely longer than broad.

Outer surface smooth with short irregular longitudinal ridges, perhaps artificially produced.

Form of leaf scars and foliage unknown.

Pith cast.

Internodes not contracted at the nodes, ribbed, ribs flattened, longitudinally striated, rounded at both extremities, bearing a large oval or circular tubercle at the upper end and very rarely a small tubercle at the lower end, separated by narrow furrows.

Basal portions of the pith cast conical, straight or bent. Internodes decreasing in length as they approach the termination where they are reduced to small more or less rhomboidal or irregularly formed ribs.

Stems arise either from other stems or from true rhizomes.

Rhizomes much more slender than the stems, internodes longer than broad with exception of those giving off stems or rhizomes which are much shortened. Ribs of rhizomes narrow, separated by shallow furrows, alternating and ending in sharp points,

with an elongated tubercle at the upper end and a row of small round prominent tubercles placed on a band at the nodes between the terminations of the ribs.

Stem scars on the rhizomes oval, somewhat undefined, one to four at a node.

Roots elongate ribbon like with fine, close transverse bars or ridges.

REMARKS.

Calamites suckowi, though one of the commonest species in the upper Carboniferous, is scarcely ever found otherwise than as a pith cast.

The only specimen showing the outer surface with which we are acquainted, is that given on Pl. 85, fig. 2, where, at the upper end the smooth impress of the bark is seen on the matrix, though very much disfigured by *Spirorbis*. This specimen also possesses the longest internodes we have seen in this species, which are 9,5 cm. long and 6,5 cm. wide.

It is extremely rare to find specimens of *C. suckowi* with internodes longer than broad.¹⁾

The general appearance of the pith cast of this species is well seen on the impression given on Pl. 86, fig. 1. Here the internodes are generally broader than long, their width being 6 cm. and their length varies from 6,75 cm. to 4,25 cm. The broad somewhat flattened ribs, about 3 mm. wide, with their large terminal tubercle are finely striated longitudinally.

A still larger example of a pith cast is given on Pl. 84. Here the internodes are even shorter although over 20 cm. broad. Another fragment of what must have been a very large stem, (as neither margin is complete), and which measures 20 cm. across, is given on Pl. 87, fig. 3. The internodes are very short varying from 2,5 to 1,5 cm. long. It is probable that this example, on account of the quickly decreasing length of the internodes is a portion from near the basal extremity of a stem. The tubercles at the upper ends of the ribs are oval and large, and the lower terminations of the ribs also bear small round tubercles. This is a most unusual occurrence on stem pith casts of *C. suckowi*. Most of the ribs do not alternate at the nodes, probably brought about by the narrowing of the stem towards its termination.²⁾

A small fragment with very wide ribs is given on Pl. 89, fig. 1. The tubercles at the upper extremities of the ribs are almost circular and occupy their whole width. Although it is the basal portion of a stem and probably corresponds in position to that given on Pl. 87, fig. 3, it shows none of the smaller tubercles on the lower terminations of the ribs.

¹⁾ See Collection KIDSTON, No. 816. This specimen is removed from the matrix and is 20,2 cm. in circumference. The longest node is 9 cm. Locality: Adderley Green Colliery, Longton, N. Staffordshire. Horizon: 12 yards below New Mine Coal, Westphalian Series.

²⁾ Similar specimens have been examined in the Historical Museum at Pilsen, Bohemia, No. M. P. 14, Kaolingrube near Zaluzi, near Pilsen.

Another portion of a stem evidently near the base, is given on Pl. 83, fig. 1. One can easily observe on this example the shortening of the internodes as the base of the stem is approached.

On the same plate, fig. 2, a termination of a stem is figured. Towards the base the internodes become very short and some of the ribs wider. At the extreme end they lose their character of regularity and the ribs appear as an aggregate of irregular, sub-oblong elevations, sometimes largely represented by the tubercle with a narrow surrounding border.

Other terminations are shown on Pl. 85, fig. 1, 3, 4, Pl. 86, fig. 2 and Pl. 88, fig. 2, 3. Those shown on Pl. 85, fig. 1, 3, 4 and Pl. 86, fig. 2 are straight, while that given on Pl. 88 is slightly bent, and the base of the stem on the left of fig. 1, Pl. 87 is still more curved.

The impression of the basal portion of the cast seen on Pl. 86, fig. 2 is given on the same plate at fig. 3. From each of the irregular, small basal ribs roots have been given off. The black circular carbonaceous patches as well as little hollows lying round them have all been root sources and a few fragments of the roots are still seen springing from the base of the specimen.

Other basal portions have been figured by STUR, *Calam. schatzl. Schichten*, Pl. 5, fig. 5, 6; WEISS, *Steink. Calam.*, II, Pl. 3, fig. 3, and ZEILLER, *Valenciennes*, Pl. 54, fig. 2.

Stems giving birth to other stems are seen on Pl. 83, fig. 3, Pl. 85, fig. 3 and Pl. 87, fig. 1, 2. In all cases it will be observed that the pith casts of the two stems are never in contact but are held in position on the fossil by a carbonaceous cushion, which arising from the base of the daughter stem expands into a wide bellshaped plate by which it is attached to the parent stem. This is seen very well at fig. 2, Pl. 87 and also at fig. 1 of the same plate, as well as at fig. 3, Pl. 85.

In the cases just mentioned the pith casts of daughter and parent stems are identical in character. Similar specimens with stems giving off other stems have been figured by STUR, *Calam. schatzl. Schichten*, Pl. 16, fig. 1, 2; WEISS, *Steink. Calam.*, II, Pl. 3, fig. 2, 3; Pl. 4, fig. 1; Pl. 17, fig. 3; ZEILLER, *Valenciennes*, Pl. 55, fig. 1; WILLIAMSON, *On the organization*, IX, Pl. 21, fig. 30.

Before passing from this subject attention may be called to the specimen given on Pl. 85, fig. 1. The centre of the fossil shows a root end of a stem transversely broken over from which six stems have arisen, but one of them, owing to the illumination of the fossil and the actual connection being broken off, is not clearly seen in the figure. A fragment of the parent stem preserved on the specimen shows that it must be from a position very near the basal apex as the internodes are very short and the ribs almost broader than long.

We have already dealt with specimens showing one stem arising from another but the most interesting specimen exhibiting this is given on Pl. 82, fig. 1, which shows two stems arising from a rhizome and a third stem arising from one of these stems. The rhizome is seen to the left margin of the plate and has four internodes from 6 to 6,5 cm.

long. It is very finely ribbed, and the ribbing and part of a node is shown enlarged at fig. 2 of the same plate. The ribs are straight, sometimes angular but usually flattened by pressure and generally alternating at the nodes, where they end in sharp points. The upper extremity of the ribs has an elongated narrow tubercle. Between the extremities of the two rows of ribs a smooth transverse band passes round the stems at the nodes. Situated on this band and free from the ribs is a verticil of small, circular tubercles, as a rule separated from each other by the extremities of two ribs. These appear to be rootlet scars. The rootlets themselves are seen on the upper part of the figure springing from the base of a stem which is in organic union with the rhizome. They have a flattened ribbon-like appearance, 0,5 cm. wide and bear close transverse ridges or markings.

The lower stem arising from this rhizome gives birth to another, which is of larger dimensions than that from which it springs.

A portion of a node of this stem cast is enlarged at fig. 3. This shows the rounded terminations of the ribs with their large tubercles. This example exhibits very clearly the bell-like expanded cushion of tissue which connects the daughter with the parent stem and which bridges over the interval between the termination of the pith cast of the daughter stem and the stem from which it arises.¹⁾

Another stem arising from a rhizome is seen on Pl. 137, fig. 2, where the distinctive characters of stem and rhizome can be clearly seen.

Text figure 67 shows a cast of the basal portion of a stem arising from another stem cast, which exhibits more the characters of an aerial stem than those of a rhizome. However, both stems must have been subterranean, as both bear roots. The parent stem shows small root tubercles at the node, from which the daughter stem arises. A larger root springing from the same node is seen at the lowest part of the figure. The daughter stem shows regular verticils of root scars at several nodes, and further it exhibits the characters known for the basal parts of stems, (short and rapidly narrowing internodes).

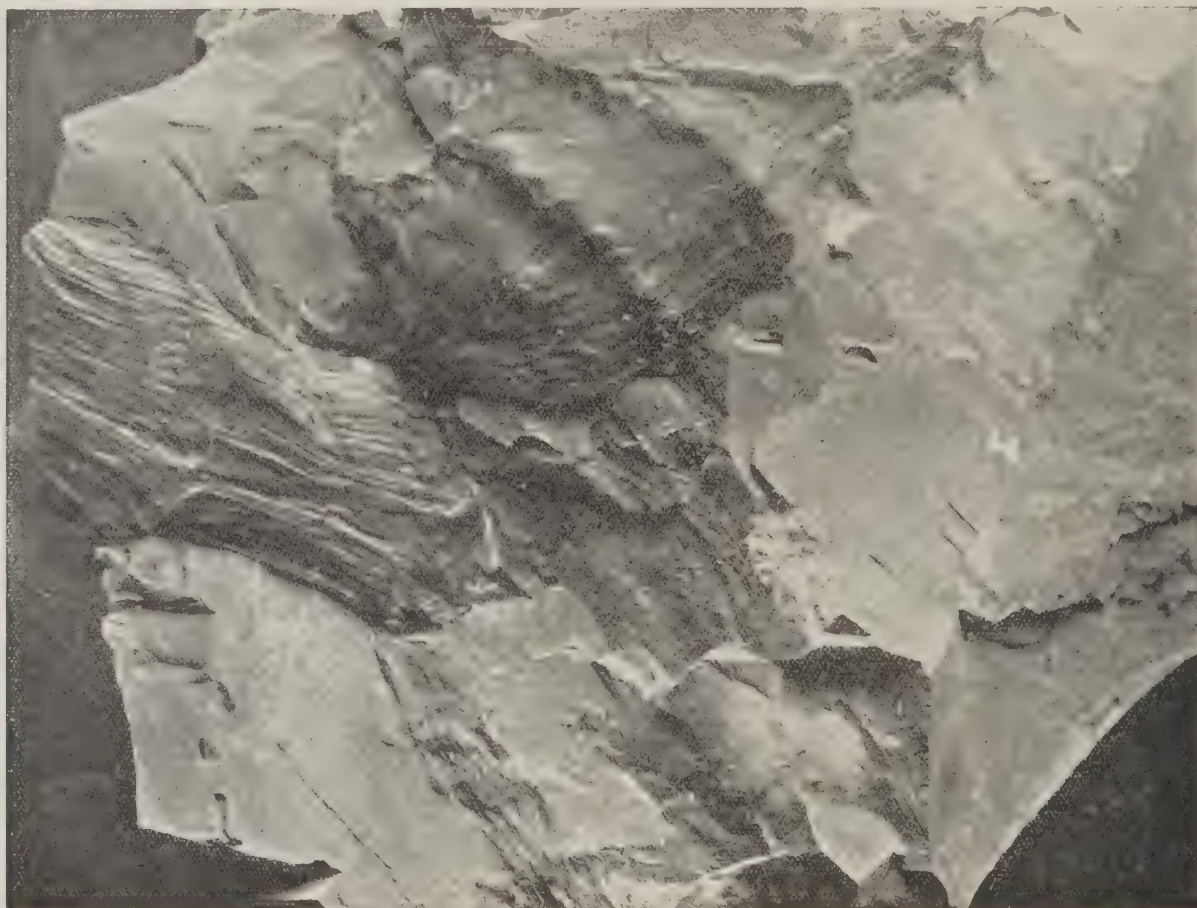
A rhizome giving rise to four daughter rhizomes is figured on Pl. 138, fig. 1. Only three of these are seen on the figure, but the other half of the specimen, which bears the impression of the other side of the pith cast, shows the scar of the fourth rhizome. On the central daughter rhizome two nodes are preserved and on this with a lens can clearly be seen the tubercles at the upper end of the ribs and the small rootlet scars forming a verticil along the course of the node.

The internodes of the rhizome, which latter seems to abruptly terminate, are very much shortened where the daughter rhizomes are given off. The second and fourth internodes from the base of the specimen show each a single rhizomatic scar from which other rhizomes seem to have originated.

¹⁾ ZALESSKY (Bull. du Comité géolog., St. Pétersbourg, No. 134, Vol. XXVI, 1907, p. 364, Text fig. 1) figures a fragment of a Calamite under the name of *C. suckowi* which gives off roots of the *Myriophyllites* type but this type of root we have never found associated with *C. suckowi*, though WEISS (Calam., I, Pl. 19, fig. 1) shows one such rootlet arising from *C. suckowi* associated with others of the ribbon-like form. The stem in ZALESSKY's figure from which the *Myriophyllites*-like roots arise, shows neither the characters of the stem nor rhizome of *C. suckowi*.

Another example of a rhizome, shown on Pl. 137, fig. 1, abruptly terminates with shortened internodes to the last of which two rhizomes are attached. The tubercles on the ends of the ribs are somewhat more oval and stem-like than those on the specimens already described, but above them can be seen the small circular scars of the rootlets.

At the lowest internode of the same specimen the finer ribbing with elongated tubercles and the verticil of small rootlet scars are purely rhizomatic in their structure and contrast strongly with those of the two daughter offsets, which in the form of the



Text fig. 67.

Calamites suckowi BGT. Westphalian Series, Netherlands, Oranje Nassau I Colliery, at a depth of 250 m. in the roof of the small seam near Pit Oranje Nassau III.

tubercles and ribbing are intermediate between those of stems and rhizomes. Probably higher up these two somewhat stem-like rhizomes may assume the form of true aerial stems.

A somewhat similar specimen is given on Pl. 90, fig. 2. Here the rhizome ends also in a shortened internode from which spring two stems. The ribs on the highest complete internode as well as the large terminal tubercles agree with those of the pith cast of stems and even at the base of the branch one cannot detect any trace of the small scars characteristic of rhizomes. The internodes on the daughter stems are exceptionally long.

Another portion of a rhizome 36 cm. long is given on Pl. 136, fig. 2, 3; fig. 2 fitting on to the top of fig. 3. The internodes vary in length from 5,75 cm. to 7,5 cm. and the rhizome is about 4,5 cm. wide at the base. From the summit of this rhizome spring three daughter rhizomes, probably the lost other half of the specimen has borne the remains of the fourth. These daughter outgrowths are distinctly rhizomatic in their structure but it is impossible to determine whether they eventually assumed the stem structure or remained as rhizomes. Like the other examples they spring from shortened internodes. As far one can observe this rhizome bears no other stem or rhizome scars.

Portions of four rhizomes are given on Pl. 39, fig. 2 and Pl. 89, fig. 2, 4, 5. Of the fragment given on Pl. 39, fig. 2 an enlargement is seen at fig. 3 which shows the terminations of the ribs and the verticil of rootlet scars lying on the band between them.

The elongated terminations of the ribs and the verticil of rootlet scars are particularly clearly seen at the nodes of the specimen given at fig. 2, Pl. 89, of which an enlargement is given at fig. 3 where these characters can be easily observed.

The two rhizomes given at fig. 4, 5, Pl. 89 might at first sight be mistaken for *C. cisti* but the presence of the sharp pointed terminations of the ribs and the verticil of small rootlet scars at once distinguish them from that species.

Among the earliest figures of *Calamites* ever published is one by SUCKOW, Pl. 18, fig. 10, which gives a most admirable figure of the rhizome of *C. suckowi*. He not only shows the sharp terminations of the ribs but also the band which separates them at the node and on which is placed the verticil of small, circular rootlet scars. His figure is the only figure previously given which shows the real characters of the rhizomatic part of *C. suckowi*.¹⁾

Still one specimen remains to which reference must be made. It is given on Pl. 88, fig. 3, and is slightly reduced. It shows a rhizome from one of whose nodes three stems are seen to arise, but probably a fourth was originally present. At the base of the rhizome towards the right hand side another stem is given off. In this example the rhizome does not terminate at the point where the stems are given off but it continues its course onwards.

Stems arising from rhizomes have been figured by WEISS (Steink. Calam., II, Pl. 2, fig. 1) and WILD (Manchester Geol. Soc., February 2nd. 1886, p. 6, fig. B, C, D. Fig. A shows stems arising from stems). FEISTMANTEL (Fruchtstadien, Pl. 2) also figures a stem arising from a rhizome or a stem, but from which it is impossible to determine.

The only species with which it is possible to confuse *C. suckowi* is *C. haueri* STUR but it is at once distinguished from this species by the blunt termination of its invariably straight ribs and the absence of the small circular branch scars of the latter species.

DISTRIBUTION.

Permian.

Germany.

Localities: Manebach. (Geol. Museum, Göttingen).

Saar Basin. (WEISS's Pl. 13, fig. 5, 1871). (Geol. Landesanstalt, Berlin).

¹⁾ SUCKOW, Act. Hist. et Comm. Acad. elect. scient. et eleg. Theod. Pal., V, Pl. 18, fig. 10 (Rhizome).

Carboniferous.

Great Britain.

Upper Coal Measures.

Radstock Series.

Radstock Group.

Localities: Radstock, Somersetshire.

Camerton, Somersetshire. (Pl. 87, fig. 3; Coll. KIDSTON, 339).

Farrington Group.

Locality: Farrington Pit, Farrington Gurney, Somersetshire.

Radstock Series.

At different localities in Monmouthshire and Glamorganshire. (South Wales).

Staffordian Series.

Horizon: About horizon of No. 1 Rhondda Seam.

Locality: Craig Blaen, Rhondda escarpment near Blaen Rhondda Farm, Glamorganshire. (South Wales).

Newcastle Group.

Horizon: ?

Locality: Railway Tunnel, Newcastle under Lyme, North Staffordshire.

Blackband Group.

Horizon: Shales above Gutter Coal.

Locality: Hampton's Marl Pit, Hanley, North Staffordshire.

New Rock Group.

Horizon: Thoroughfare Seam.

Locality: Kingswood near Bristol, Somersetshire.

Westphalian Series.

Very common.

Localities of figured specimens:

Horizon: Above Crow Coal.

Locality: Moody's Quarry, York Road, Leeds, Yorkshire. (Pl. 88, fig. 2). (Coll. KIDSTON, 2681).

Horizon: Below Black Bed Coal.

Locality: Dolly Lane, Leeds. (Pl. 89, fig. 1). (Coll. KIDSTON, 2681).

Horizon: Bensham Seam,

Locality: Jarrow, County of Durham. (Pl. 85, fig. 1; Pl. 87, fig. 2; Pl. 90, fig. 2). (HUTTON Collection, Museum, Newcastle-on-Tyne.)

Horizon: Band above Barnsley Thick Coal.

Locality: Oaks Colliery near Barnsley. (Pl. 87, fig. 1). (Coll. KIDSTON, 2218).

Horizon: Barnsley Thick Coal.

Locality: Monckton Main Colliery near Barnsley. (Pl. 86, fig. 2, 3). (Coll. KIDSTON, 1907).

Lanarkian Series.

Very Common.

Locality of figured specimen:

Horizon: Kiltongue Coal.

Locality: Ellismuir, Ballieston, Lanarkshire. (Pl. 88, fig. 3). (DUNLOP Coll., Pittencrieff Museum, Dumfermline).

Netherlands.

Westphalian Series.

Equivalent of the Lower "Gaskohle" or Upper "Fettkohle" of the Rheno-Westfalian Coalfield.

Horizon: Shales under Seam II, at 253 m.

Locality: Hendrik Colliery, Brunssum, near Heerlen, Limburg, Pit I. (Pl. 136, fig. 2, 3; Pl. 137, fig. 1, 2; Pl. 138, fig. 1).

Equivalent of the Lower "Fettkohle" of the Rheno-Westfalian Coalfield.

Horizons: Under Seam IV, (Pl. 85, fig. 2); Seam V, (Pl. 82, 84, Pl. 86, fig. 1); Seam VI; Seam VIII.

Locality: Wilhelmina Colliery, near Heerlen, Limburg.

Horizon: Between Seams V and VI.

Locality: Oranje Nassau II Colliery, near Heerlen, Limburg.

Horizons: Between Seams IV and V, (Pl. 85, fig. 4); Seam V; Seam VIII.

Locality: Laura en Vereeniging Colliery, near Heerlen, Limburg.

Horizon: Seam I.

Locality: Oranje Nassau I Colliery, near Heerlen, Limburg.

Horizon: Shales over Seam II, at 228 m.

Locality: Emma Colliery, near Heerlen, Limburg.

Horizon: Seam Groot Athwerk.

Locality: Dominiale Mijn, Kerkrade, Limburg.

Horizon: Seam Groot Athwerk.

Locality: Willem Sophie Colliery, near Kerkrade, Limburg.

Equivalents of the "Gaskohle", "Fettkohle" and "Magerkohle" of the Rheno-Westfalian Coalfield.

Common in the different borings in Limburg and in the Peel-Basin.

Belgium.

Westphalian Series.

Common.

Hainaut, vide KIDSTON, 1911, Mém. Mus. Roy. d'Hist. nat. de Belgique, Vol. IV.

Horizon: ?

Localities: United Collieries of Charleroi, Pit No. 12. (RENIER, 1910, Pl. 43a).

Colliery of the "Borinage central," Pit No. 1. (RENIER, 1910, Pl. 43b).

France.

Common in the different basins.

Bassin du Nord.

Westphalian Series.

Horizon: ?

Locality: Pit Saint Charles, Anzin near Valenciennes. (BRONGNIART's Pl. 15, fig. 5, 6).

Horizon: Seam Printanière Levant.

Locality: Collieries of Anzin, Pit Thiers. (ZEILLER's Pl. 159, fig. 1, 1878—80).

Horizon: Seam No. 3.

Locality: Collieries of l'Escarpelle, Pit No. 4. (ZEILLER's Pl. 55, fig. 1).

Pas de Calais.

Westphalian Series.

Horison: Passée de Noireux over Seam Saint Alexis.

Locality: Collieries of Bully Grenay. (ZEILLER's Pl. 54, fig. 2).

Horizon: ?

Locality: Collieries of Liévin, Pit No. 3. (ZEILLER's Pl. 54, fig. 3).

Loire Coalfield.

Stephanian Series.

Horizon: Second Couche au plâtre.

Locality: Pit of La Pompe, Treuil. (GRAND' EURY's Pl. 1, fig. 1, 2, 3, 1877).

Blanzy Coalfield.

Stephanian Series.

Horizon: In the Roof of the first Grande Couche.

Locality: Collieries of Blanzy, Découvert Saint François. (ZEILLER's Pl. 37, fig. 1).

Creusot Coalfield.

Stephanian Series.

Horizon: Under the Grande Couche.

Locality: Collieries of Creusot, Pit Chaptal. (École supér. des Mines, Paris).

Commentry.

Stephanian Series.

Horizon: Under the Grande Couche.

Locality: Trench of Forêt in sandstone. (RENAULT's Pl. 44, fig. 4, 5).

Horizon: In the Roof of the Grande Couche.

Locality: Trench of Saint Edmond. (RENAULT's Pl. 44, fig. 1, 3).

Calvados.

Stephanian Series.

Horizon: ?

Locality: Collieries of Litry. (BRONGNIART's Pl. 16, fig. 2).

Switzerland.

Upper Westphalian Series.

Horizon: ?

Locality: Toedi. (ROTHPLETZ, 1880).

Italy.

Stephanian Series.

Horizon: ?

Localities: Traina. (STEFANI's Pl. 10, fig. 3).

Iano. (STEFANI's Pl. 10, fig. 4).

Germany.

Common in the different coalfields.

Stephanian Series.

Horizon: ?

Locality: Wettin.

Aachen Coalfield.

Westphalian Series.

Horizon: ?

Locality: Eschweiler near Aachen. (WEISS, 1876, Pl. 19, fig. 1; STUR's Pl. 3, fig. 4).

Horizon: Seam Furth.

Locality: Colliery Eschweiler Reserve.

Horizon: Seam Gross Langenberg.

Locality: Gouley Colliery. (Rijks Opsporing van Delfstoffen).

Horizon: Seam Rauschenwerk.

Locality: Kämpchen Colliery. (Rijks Opsporing van Delfstoffen).

Rheno=Westfalian Coalfield.

Westphalian Series.

Common, especially in the "Fettkohle," vide JONGMANS and KUKUK, 1913, p. 22-24.

Saar Coalfield.

Upper Westphalian Series.

Horizon: Carl-Seam.

Locality: Gerhard Colliery. (Geolog. Landesanst., Berlin).

Horizon: ?

Localities: Duttweiler. (Geolog. Museum, Strassburg).

Camphausen Pit near Saarbrücken. (WEISS, 1884, Pl. 27, fig. 3).

Jägerfrau near Saarbrücken. (Palaeobotanical Museum, Kgl. Svensk. Vetensk. Akad.) (*C. suckowi* var. *canaliculatus* GOLDENBERG mnsr.)

Upper Silesia.

Westphalian Series.

Horizon: Muldengruppe.

Locality: Orzesche. (WEISS, 1884, Pl. 4, fig. 1).

Lower Silesia.

Westphalian Series.

Schatzlarer Schichten.

Horizon: Seam 7.

Locality: Glückhelf Colliery, Hermsdorf. (STUR's Pl. 16, fig. 1).

Horizon: ?

Localities: Waldenburg. (FEISTMANTEL's Pl. 4, fig. 1, 2; Pl. 5).

Gustav Colliery near Schwarzwaldau. (WEISS, 1884, Pl. 3, fig. 2, 3).

Fuchs Colliery, Weissenstein near Waldenburg. (STUR's Pl. 5, fig. 6).

Baden.

Stephanian Series.

Ottweiler Schichten.

Horizon: Lumenschieder Seam.

Locality: Diersburg. (Geolog. Landesanstalt, Berlin); (STERZEL's Pl. 18, fig. 1).

Horizon: ?

Locality: Hohengeroldseck. (STERZEL's Pl. 31, fig. 2).

Westphalian Series.

Horizon: ?

Locality: Hinterohlsbach. (STERZEL's Pl. 18, fig. 1).

Saxony.

Westphalian Series.

Horizon: ?

Localities: In shales near Bockwa. (GEINITZ, Pl. 13, fig. 1, 2; STUR's Pl. 3, fig. 3).

Near Niedercainsdorf. (GEINITZ, Pl. 13, fig. 3, 5).

Oberhohndorf. (GEINITZ, Pl. 13, fig. 6; WEISS, 1884, Pl. 17, fig. 5).

Austria.

Westphalian Series.

Schatzlarer Schichten.

Horizon: Seam 7—8.

Locality: Karwin, Gräfl. Larisch'scher Bau. (STUR's Pl. 16, fig. 2).

Horizon: ?

Locality: Hruschau, Moravia. (HOFMANN and RYBA's Pl. 1, fig. 6).

Bohemia.

Stephanian Series (Lower Part) or Westphalian Series (Upper Part).

Horizon: ?

Localities: Nürschan (Nyran) near Pilsen. (FEISTMANTEL's Pl. 2, fig. 3; Pl. 3, fig. 2).

Kaolingrube near Zaluži, Pilsen. (Historisches Museum, Pilsen).

Lisek Coalfield near Beraun: Dibri. (FEISTMANTEL, Studien, 1874, Pl. 1, fig. 2).

Hyskow. (FEISTMANTEL, Böhmen, Pl. 3, fig. 1).

Westphalian Series.

Horizon: ?

Localities: Bras near Radnitz. (FEISTMANTEL's Pl. 6, fig. 1).

Schwadowitz. (FEISTMANTEL's Pl. 2, fig. 4).

Hungary.

Stephanian Series.

Horizon: Ottweiler Schichten.

Locality: Dragoselo near Berzacko. (*C. ettingshauseni* STUR mnsr.; Geol. Reichsanst., Wien; our Pl. 89, fig. 4).

Russia.

Westphalian Series.

According to ZALESSKY in the Coalfields of the Donetz and Dombrowa.

Spain.

Westphalian Series.

Horizon: ?

Localities: Central Basin, Mieres, near Olloniego, Sama, Mosquitera; Onis. (ZEILLER, Mém. de la Soc. géol. du Nord, I, 3, 1882, p. 3).

Canada.

Westphalian Series.

Horizon: ?

Localities: Little River Group. (MATTHEW, 1906).

Fern Ledges, St. John, New Brunswick. (STOPES, 1914; DAWSON's *C. cannaeformis*, 1871).

CALAMITES CISTI BRONGNIART.

Pl. 94, fig. 1, 2; Pl. 95, fig. 2, 3, 4, 5; Pl. 96, fig. 1, 2; ? Pl. 106, fig. 5; Pl. 158, fig. 1;
Text fig. 68.

1828 *Calamites cisti* BGT., Histoire, I, p. 129, Pl. 20, fig. 1–5.

1828 *Calamites cisti* BGT., Prodrôme, p. 38.

1845 *Calamites cisti* UNGER, Synopsis, p. 22.

1848 *Calamites cisti* GOEPPERT, in Bronn, Index palaeont., p. 198.

1848 *Calamites cisti* SAUVEUR, Belgique, Pl. 8, fig. 3; ? Pl. 9, fig. 1; (non Pl. 11, fig. 1, 2).

1850 *Calamites cisti* UNGER, Gen. et spec., p. 46.

1853 *Calamites cisti* MARCOU, Geol. map of N. America, p. 38, Pl. 5, fig. 1.

1855 *Calamites cisti* GEINITZ, Sachsen, p. 7, ? Pl. 13, fig. 7; (non Pl. 11, fig. 7, 8; non Pl. 12, fig. 4, 5).

1876 *Calamites cisti* HEER, Flora foss. Helvetiae, Lief. I, p. 47, ? Pl. 20, fig. 3; (non fig. 1, 2, 4).

1877 *Calamites cisti* GRAND' EURY, Loire, p. 19, Pl. 2, fig. 2, (non fig. 1, 3).

1880 *Calamites cisti* ROTHPLETZ, Toedi, Abh. schweiz. Palaeont. Ges., V, p. 3, ? Pl. 2, fig. 3.

1882 *Calamites cisti* RENAULT, Cours, II, p. 162, Pl. 24, fig. 7.

1886 *Calamites cisti* ZEILLER, Valenciennes, Atlas, Pl. 56, fig. 1, 2; Text, 1888, p. 342.

- 1886 *Calamites cisti* STERZEL, Rotl. im nordw. Sachsen, Dames u. Kayser's Palaeont. Abh., III, 4, p. 12 (246), ? Pl. 2, fig. 3; (non Pl. 1, fig. 8; Pl. 2, fig. 1, 2; Pl. 3, fig. 1; Pl. 8, fig. 2).
- 1888 *Calamites cisti* RENAULT, Commentry, Atlas, Pl. 43, fig. 4; (non Pl. 44, fig. 1; Pl. 57, fig. 4); Text, II, 1890, p. 389.
- 1890 *Calamites cisti* GRAND' EURY, Gard, p. 217, ? Pl. 15, fig. 1, (non fig. 2).
- 1899 *Calamites cisti* HOFMANN and RYBA, Leitpflanzen, p. 25, Pl. 1, fig. 11.
- 1906 *Calamites cisti* MATTHEW, Little River Group, I, Trans. Roy. Soc. Canada, (2), XII, Sect. IV, No. 10, p. 110, ? Pl. 3, fig. 1, 2.
- 1907 *Calamites cisti* YOKOYAMA, Journ. Coll. Science, Tokyo, XXIII, No. 9, p. 13, ? Pl. 4, fig. 2, 3.
- 1911 *Calamites cisti* KIDSTON, Hainaut, Mém. Mus. Roy. Hist. nat. de Belgique, IV, p. 115.
- 1911 *Calamites cisti* JONGMANS, Anleitung, I, p. 185, fig. 153, 154, 155, (non fig. 156).
- 1913 *Calamites cisti* JONGMANS and KUKUK, Calam. Rhein. Westf. Kohlenb., Mededeel. Rijks Herbarium, Leiden, No. 20, p. 24, Pl. 22, fig. 1.
- 1907 *Calamites suckowi forma cisti* STERZEL, Karbon Baden, Mitt. Grossh. Bad. Geol. Landesanst., V, 2, p. 433, 466, 507, Pl. 32, fig. 2; Pl. 68, fig. 4.
- 1906 *Calamites cisti mutatio* MATTHEW, Little River Group, I, Trans. Roy. Soc. Canada, (2), XII, Sect. IV, p. 110, ? Pl. 3, fig. 1, 2.
- 1828 *Calamites dubius* BGT. (non Artis), (pars), Histoire, I, p. 130, Pl. 18, fig. 3, (non fig. 1, 2).
- 1854 *Calamites tenuifolius* ETTINGSHAUSEN, (pars), Radnitz, Abh. K.K. Geol. Reichsanst., Wien, II, 3, 3, p. 27, Pl. 3, fig. 4.
- 1887 *Calamites schatzlarensis* STUR, (pars), Calam. Schatzl. Schichten, Pl. 14b, fig. 4.
- 1890 *Calamites foliosus* GRAND' EURY, Gard, p. 217, ? Pl. 15, fig. 3–6.
- 1784 *Calamites* SUCKOW, Act. Hist. et Comm. Acad. elect. scient. et eleg. litt. Theod. Pal., V, ? Pl. 17, fig. 5–7.

DESCRIPTION.

Pith cast.

Internodes longer than broad or broader than long, attaining a length of 13 cm. or more, with a width of 10 cm. or more. Ribs alternating at the nodes, tapering to a subacute point, upper end with a more or less oval-elongate tubercle. Some of the ribs at their lower end sometimes have a small tubercle. Ribs longitudinally striated, ridged or flattened (by pressure), separated by a straight furrow, bordered on each side by a prominent line.

Outer surface and foliage unknown.

REMARKS.

As far as our experience goes *C. cisti* appears to be a rather rare fossil and many of the specimens which have been referred to it are imperfectly preserved and do not show the critical characters by which a satisfactory identification can be made. Some of these may have been imperfectly preserved rhizomes of *C. suckowi* or imperfect specimens of *C. sachsei*. We have therefore thought it necessary to interrogate or exclude many of the figures referred to *C. cisti*. It is possible that some of these queried or rejected records may have been made on true specimens of this species but as the figures do not

show the essential character for their identification we have thought it safer to reject them from the synonymy.

At fig. 2, Pl. 95 is given a fragment of a cast which we regard as typical of this species. The internodes here are longer than broad. The ribs are narrow and straight,

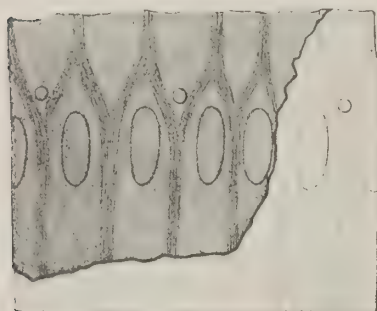


Fig. 68.

Calamites cisti BGT.
Termination of ribs. (copied
from ZEILLER).

separated by a double lined furrow which can be seen at several parts of the figure. The ribs are longitudinally striated and their upper ends show the characteristic elongated tubercles. The terminations of the ribs and their tubercles are well seen in Text fig. 68 which is copied from ZEILLER.

Another very typical example is given on Pl. 158, fig. 1. Here the double lined furrows separating the ribs, and the gradual contraction of the ribs into a blunt point as well as the terminal tubercles, can all be clearly seen when the figure is examined with a lens. The terminations of the ribs at the upper end of the second node from the base are seen to contract slightly below the tubercle, which seems to form a little bulb-like termination, in a similar manner to that seen

in the enlargement given by BRONGNIART on his Pl. 18, fig. 3.

On Pl. 94 two other specimens are given. That at fig. 1 shows very well the tubercles, which are slightly more broadly oval than those on the two specimens just described. It however, like them, shows an entire absence of any constriction at the nodes. Fig. 2 illustrates with great clearness the double line limiting the furrow as well as the gradually tapering pointed ribs. This pith cast measures about 10 cm. in width and is the widest example we have yet met with.

A large pith cast removed from its matrix, is given on Pl. 96, fig. 1, and on the same plate is shown another example at fig. 2. That at fig. 2 has an internode 13 cm. in length which is the maximum length we have yet met with in the internodes of this species. Fig. 1 illustrates the fine straight ribbing of the internodes.

One of BRONGNIART's original types, that on his Pl. 20, fig. 4, is reproduced on our Pl. 95, fig. 4 and an enlargement of part of a node is given on the same plate at fig. 5. The specimen is somewhat crushed but the enlargement shows the elongate terminal tubercles and the dividing furrows bordered by two lines, so characteristic of *C. cisti*.

On Pl. 106, fig. 5 part of a cast of a *Calamites* is given which with considerable doubt we refer to *C. cisti*. The ribs are straight with elongate tubercles at their upper ends and the nodes show no constriction. The short internode towards the lower end of the figure bears at its base a verticil of small scars. The general appearance of the specimen is that of *C. cisti* but its preservation is such that one cannot with certainty refer it to that species. *C. cisti* has frequently been recorded from the Lanarkian Series of Britain but a critical examination of the specimens leaves in our mind considerable doubt as to the plants so identified being really referable to this species. We therefore omit all the records for *C. cisti* from the Lanarkian Series until the occurrence of the plant is confirmed.

We are especially led to take this course since the discovery of the rhizome of *C. suckowi*, which if imperfectly preserved would almost certainly have been named *C. cisti* and we feel that the whole distribution of the latter species requires to be carefully worked out anew.

When well preserved specimens are examined (and for critical work such are necessary), there is no difficulty in distinguishing *C. cisti* from all the other species. Its gradually narrowing ribs which end in a blunt or subacute point, their elongated tubercle, the double lined furrow, and the unconstricted nodes afford sufficient characters of identification, by which it may be easily distinguished from all other members of the genus.

Some authors have united *C. dubius* Artis with *C. cisti*, which though it shows a double lined furrow dividing the ribs is strongly contracted at the nodes, a character entirely unknown in *C. cisti*. (ARTIS, Antediluv. Phytol., Pl. 13; BGT., Histoire, I, p. 130, Pl. 18, fig. 1, 2, [non fig. 3]).

DISTRIBUTION.

Permian.

Germany.

Saxony.

Horizon: ?

Locality: Plagwitz-Leipzig. (STERZEL, 1886).

Baden.

Horizon: Cuseler Schichten.

Locality: Heidenknie near Durbach. (STERZEL, 1907, Pl. 68, fig. 4).

Carboniferous.

Great Britain.

Radstockian Series.

Horizon: Radstock Group.

Localities: Radstock, Somersetshire. (Pl. 96, fig. 1). (Coll. KIDSTON, 333).

Braysdown Colliery near Radstock.

Wellsway Pit near Radstock.

Lower Writhlington Pit, near Radstock.

Camerton, Somersetshire.

Staffordian Series.

Horizon: No. 2 Rhondda Seam.

Locality: Cambrian Collieries, Clydach Vale, Rhondda, South Wales. Collected by D. DAVIES.

Westphalian Series.

Not uncommon. Our Pl. 95, fig. 2: Melton Field Coal, Hoyle Mill, Barnsley, Yorkshire. (Coll. KIDSTON, 1632).

Lanarkian Series.

Records require confirmation.

Netherlands.

Westphalian Series.

Equivalent of the "Gaskohle" and "Fettkohle" of the Rheno-Westfalian Coalfield.

Not uncommon in the different borings in Limburg and in the Peel-Coalfield.

Equivalent of the Lower "Fettkohle" of the Rheno-Westfalian Coalfield.

Horizons: Seam VI, (Pl. 94, fig. 1, 2; Pl. 96, fig. 2); Seam VIII.

Locality: Wilhelmina Colliery, near Heerlen, Limburg.

Horizons: Between Seams IV and V; Seam VIII.

Locality: Laura en Vereeniging Colliery, near Heerlen.

Horizon: Seam V.

Locality: Oranje Nassau II Colliery, near Heerlen.

Horizons: Seam Groot Athwerk; Seam Groot Mühlenbach; Seam Steinknipp.

Locality: Dominiale Mijn, Kerkrade, Limburg.

Belgium.

Westphalian Series.

Horizon: ?

Locality: Coll. des Produits, Pit No. 23. (ZEILLER's Pl. 56, fig. 1).

Horizons: Seams Avalaresse, Qu'on have, d'Or and du Parc.

Locality: Mariemont Collieries, Pit Réunion. (Coll. DELTENRE).

Horizons: Seam Gigotte and Olive.

Locality: Mariemont Collieries, Pit Placard. (Coll. DELTENRE).

Horizon: Seam Jules.

Locality: Mariemont Collieries, Pit St. Eloi. (Coll. DELTENRE).

Horizon: Seam Couteau.

Locality: Grande Bacnure Colliery, Pit Gérard Cloes. (Coll. Université, Liège).

Horizon: Seam Bostin Piquette.

Locality: Fond Piquette Colliery, Pit Soxkluse. (Coll. Université, Liège).

Horizon: Seam Franois.

Locality: Levant du Flénu Colliery. (Coll. RENIER).

France.

Stephanian Series.

Horizon: In the roof of Seam No. 2 at 206 m.

Locality: Montvicq Colliery, Commentry. (RENAULT's Pl. 43, fig. 4).

Horizon: 5 M. over the Grande Couche.

Locality: Trench of Saint Augustin, Commentry. (RENAULT's Pl. 57, fig. 4).

Westphalian Series.

Horizon: Seam St. Joseph.

Locality: Collieries of Bully Grenay, Pit No. 5, Pas de Calais. (ZEILLER's Pl. 56, fig. 2).

Switzerland.

Upper Westphalian Series.

Horizon: ?

Locality: Psychagnard. (HEER's Pl. 20, fig. 3).

Toedi. (ROTHPLETZ, 1880).

Germany.

Aachen=Coalfield.

Westphalian Series.

Horizon: ?

Locality: Centrum Colliery near Eschweiler. (Geolog. Landesanstalt, Berlin).

Horizons: Seams Gross Athwerk and Klein Athwerk.

Locality: Langenberg Colliery. (Coll. Rijks Opsporing van Delfstoffen).

Horizons: Seams VIII and XI.

Locality: Maria Colliery, Hauptschacht. (Coll. Rijks Opsporing van Delfstoffen).

Horizon: Seam III.

Locality: Anna Colliery. (Coll. Rijks Opsporing van Delfstoffen).

Niederrhein.

Westphalian Series.

Localities: Boring 58, in Appeldorn, at 722 m. (Geolog. Landesanstalt, Berlin).

Boring 79, Hamb near Kapellen, at 408—410 m. (Geolog. Landesanstalt, Berlin).

Rheno=Westphalian Coalfield.

Westphalian Series.

Frequent cf. JONGMANS and KUKUK, 1913.

Saar Coalfield.

Westphalian Series.

Horizon: ?

Locality: Duttweiler. (*C. schatzlarensis* STUR's Pl. 14 b, fig. 4).

Lower Silesia.

Westphalian Series.

Horizon: ?

Locality: Waldenburg. (Hofmuseum, Wien).

Baden.

Stephanian Series.

Horizon: ?

Locality: Hohengeroldseck. (STERZEL, 1907, Pl. 32, fig. 2).

Saxony.

Upper Westphalian Series.

Horizon: ?

Localities: Frisch Glück Pit near Oelsnitz. (Geolog. Landesanstalt, Leipzig).

Helene Pit near Oelsnitz. (Geolog. Landesanstalt, Leipzig).

Austria.

Westphalian Series.

Horizon: Schatzlarer Schichten.

Localities: Radnitz. (Coll. STERNBERG, Böhmisches Museum, Prag).

Wranowitz. (C. tenuifolius ETTINGSHAUSEN's Pl. 3, fig. 4).

Hungary.

Stephanian Series.

Horizon: ?

Locality: Sagradja. (Geol. Reichanstalt, Wien; our Pl. 95, fig. 3).

United States of America.

Series?

Horizon: ?

Locality: Wilkesbarre, Pennsylvania. (BGR.'s Pl. 20, fig. 4, our Pl. 95, fig. 4, 5).

Canada.

Westphalian Series.

Horizon: ?

Locality: Little River Group. (MATTHEW).

CALAMITES GIGAS BRONGNIART.

Pl. 90, fig. 3, 4, 5; Pl. 91; Pl. 92, fig. 1, 2, 3; Pl. 93, fig. 1, 2; Pl. 96, fig. 3.

- 1828 *Calamites gigas* BGT., Histoire, I, p. 136, Pl. 27.
- 1833 *Calamites gigas* STERNBERG, Versuch, II, Fasc. 5, 6, p. 50.
- 1845 *Calamites gigas* BGT., in MURCHISON, VERNEUIL et KEYSERLING, Géologie de la Russie, II, Pt. 3, p. 11, 13, Pl. G, fig. 8.
- 1848 *Calamites gigas* GOEPPERT in BRONN, Index palaeont., p. 199.
- 1849 *Calamites gigas* GUTBIER, Verstein. des Rothlieg. in Sachsen, p. 7, Pl. 9, fig. 4, 5.
- 1850 *Calamites gigas* UNGER, Gen. et spec., p. 49.
- 1862 ? *Calamites gigas* GEINITZ, Dyas oder die Zechsteinform., II, p. 134, (? Pl. 25, fig. 1).
- 1864—65 *Calamites gigas* GOEPPERT, Flora d. Perm. Form., Palaeontogr., XII, p. 32, Pl. 2, fig. 2, 3, (? non fig. 1).
- 1869 *Calamites gigas* SCHIMPER, Traité, I, p. 319, Pl. 20, fig. 2, 4.
- 1871 *Calamites gigas* WEISS, Foss. Fl. jüngst. Steink. und Rothl., p. 117, Pl. 13, fig. 8; Pl. 14, fig. 2.
- 1879 *Calamites gigas* ZEILLER, Explic. de la carte géol. de la France, IV, 2, p. 16; (1880, Végét. foss. terr. houill., p. 16).
- 1892 *Calamites gigas* ZEILLER, Flore de Brive, p. 62.
- 1899 *Calamites gigas* HOFFMANN and RYBA, Leitpflanzen, p. 26, Pl. 1, fig. 12.
- 1906 *Calamites gigas* ZEILLER, Flore de Blanzay et du Creusot, p. 129.
- 1911 *Calamites gigas* JONGMANS, Anleitung, I, Mededeel. Rijks Opsporing van Delfstoffen, No. 3, p. 181, fig. 149, (non fig. 150).
- 1896 *Arthropitys gigas* RENAULT, Flore d'Autun et d'Épinac, II, p. 96, Pl. 49; Pl. 51, fig. 1; (? Anatomy Pl. 50; Pl. 51, fig. 2—7).
- 1896 *Arthropitys gigas* RENAULT, Notice sur les Calamar., II, Bull. Soc. hist. nat. d'Autun, IX, p. 316 (sep. copy, p. 12), Pl. 4.
- 1845 *Calamites suckowi* var. *major* BGT., in MURCHISON, VERNEUIL et KEYSERLING, Géologie de la Russie, II, 3, p. 13, Pl. D, fig. 1a, b.
- 1871 *Calamites major* WEISS, Foss. Fl. jüngst. Steink. u. Rothl., p. 119, Pl. 13, fig. 6; Pl. 14, fig. 1. (One half natural size).
- 1886 *Calamites major* STERZEL, Rothlieg. im nordw. Sachsen, Dames u. Kayser's Palaeontol. Abhandl., III, 4, p. 54 (288), Pl. 7 (27), fig. 8.
- 1890 *Calamites major* GRAND'EURY, Gard, p. 210, Pl. 14, (? fig. 13), fig. 14.
- 1892 *Calamites major* ZEILLER, Flore de Brive, p. 59.
- 1906 *Calamites major* ZEILLER, Flore de Blanzay et du Creusot, p. 128.
- 1911 *Calamites major* JONGMANS, Anleitung, I, Mededeel. Rijks Opsporing van Delfstoffen, No. 3, p. 183, fig. 151.
- 1864—65 *Calamites suckowi* GOEPPERT, (non BGT.), Flora der Perm. Form., Palaeontogr., XII, p. 34, Pl. 1, ? fig. 3, (? non fig. 4).
- 1869 *Calamites cannaeformis* SCHIMPER, (non SCHL.), (pars), Traité, I, p. 316, Pl. 20, fig. 1.
- 1888 *Calamites cannaeformis* RENAULT, (non SCHL.), (pars), Commentry, p. 393, Pl. 44, fig. 7.
- 1889 *Calamites ostraviensis* TONDERA, (non STUR), Flora Kopalnej, Pamietn. Wyd. mat. przyr. Akad. Umiej. w Krakowie, XVI, p. 10, Pl. 13, fig. 7.
- 1893 *Calamites weissi* STERZEL, (pars), Rothl. im Plauenschen Grunde, Abh. Math. Phys. Cl. K. sächs. Ges. d. Wiss., XIX, p. 92, (non Pl. 8, fig. 7).

DESCRIPTION.

Pith cast very large, 20 cm. or more wide. Internodes broader than long, rarely longer than broad. Ribs attaining a width of 1,1 cm., usually alternating at the nodes and ending in prolonged acute points with a large oval tubercle at their upper end and occasionally a small one at their lower extremity. Surface of ribs longitudinally striated or granulate.

Outer surface unknown.

REMARKS.

If one may judge from the width of the ribs seen on the pith cast of *C. gigas* this species probably attained a larger dimension than any other member of the Genus. On Pl. 93, fig. 2, a fragment of a very large pith cast is seen, where one of three ribs which do not alternate at the lower node attains a width of 1,1 cm. The real distinctive character of this species, — the sharp elongated points of the ribs, — is illustrated very clearly in this figure, as well as the frequent non-alternation of the ribs at the node, where at the left hand side of the figure four or five of them lying in a band pass straight over two nodes without any sign of alternation.

Other fragments of large stems are given on Pl. 92, fig. 2, 3 and Pl. 96, fig. 3. All of these figures show very distinctly the much elongated and sharp pointed terminations of the ribs, the great distinctive character of this species. The roughness seen on some of the ribs on Pl. 92, fig. 2 probably represents the coarse matrix in which the fossil is preserved.

A large pith cast with very short internodes is given on Pl. 91. The majority of the ribs here alternate and a considerable amount of variation is seen in the form of their terminations. In some cases especially where the internodes are longer the point is acute and elongated while on the short internodes the extremities are more rectangular.

A fragment of a small pith cast is given at fig. 1, Pl. 92. The surface of the ribs is finely striated and here curiously enough those ribs which show the most produced points are situated on the shortest internode. The lowest internode bears a simple scar to which the ribs converge.

Another fragment of a small pith cast, one of those originally figured by WEISS, (1870, Pl. 13, fig. 6) under the name of *C. major*, is given on Pl. 90, fig. 4, an enlarged portion of which is seen at fig. 5. This latter figure shows the much elongated points of the ribs, their upper oval tubercles and small tubercles at their bases. The longitudinal striations are here seen to be broken up into a punctate granulation.

Two basal portions of the pith cast are illustrated on Pl. 90, fig. 3 and Pl. 93, fig. 1. That on Pl. 90, fig. 3 has been figured as *C. cannaeformis* by RENAULT and shows two nodes with the characteristic sharp terminations of their ribs, but is otherwise not very well preserved.

That on Pl. 93, fig. 1 is complete and shows the gradual diminuation in the length of the internodes as they approach the base. The terminations of the ribs are well seen at the uppermost internode and are characteristically those of *C. gigas*. The tubercles are present on the second node from the top. At the base of the cast the short ribs become very broad.

The specimens referred to *Arthropitysgigas* by RENAULT in his Flore de Commentry, have on examination all been found to belong to *C. undulatus*.

The *C. weissii* STERZEL, is founded partly on a fossil described by WEISS and on another figured by himself. WEISS placed his specimen under the name of *C. major* and any characters it possesses are indistinguishable from those of *C. gigas* with which we unite *C. major*.

But the specimen of *C. weissii*, figured by STERZEL himself, (Abh. Math. Phys. Cl. k. Sächs. Ges. der Wissensch., XIX, 1893, p. 92, Pl. 8, fig. 7, 7A) is very badly preserved and can only be described as a crushed *Calamites* that possesses no characters whatever on which a species can be founded.

Calamites undulatus is distinguished from *C. gigas* by its much less sharp pointed, and usually undulated ribs with cross-hatching on their surface.

DISTRIBUTION.

Stephanian Series and Permian.

Russia.

Permian.

Localities: Nijni Troisk, District Belebeg, and Pyskork, Gouvern. Orenburg. (BRONGNIART, EICHWALD).

Near Perm. (BRONGNIART, EICHWALD).

Valley of the Dioma. (RENAULT, Autun, Pl. 49, fig. 4).

Bohemia.¹⁾

Stephanian Series (or Permian).

Locality: Sandstone Quarries near Kotikov. (Histor. Museum, Pilsen).

Poland.

Permian.

Locality: Jaworzno. (TONDERA's *C. ostraviensis*).

¹⁾ GOEPPERT mentions Braunau, we did not see specimens from this locality.

Germany.¹⁾

Permian.

Localities: Porphyrtuff, Wolftitz near Frohburg. (STERZEL).

Walchia-Sandstone, Naumburg, Wetterau. (GEINITZ, 1862, Pl. 25, fig. 1).

Near Neurode. (Geol. Landesanstalt, Berlin; our Pl. 92, fig. 3).

Oberhöfer Schichten, Thuringia, Neue Wasserleitung beim oberen Schweizerhaus. (Geol. Landesanstalt, Berlin).

Saar Coalfield.

Localities: Schwarzenbach near Birkenfeld. (WEISS, Pl. 13, fig. 6, Geol. Institute, Strassburg, our Pl. 90, fig. 4; Geolog. Landesanstalt, Berlin).

Steimel near Meisenheim. (WEISS, Pl. 14, fig. 2, Geolog. Landesanstalt, Berlin, our Pl. 93, fig. 2).

Near Otzenhausen. (WEISS, Pl. 14, fig. 1, figured on half natural size).

Wellesweiler near Saarbrücken. (SCHIMPER).

Saarbrücken. (SCHIMPER's Pl. 20, fig. 4, and *C. cannaeformis* SCHIMPER's Pl. 20, fig. 1, our Pl. 92, fig. 1).

France.

Brive Coalfield.

Permian.

Localities: Gourd du Diable and Objat. (École supér. des Mines, Paris; our Pl. 91).

Autun Coalfield.

Permian.

Locality: Dracy Saint Loup and Champ des Espargeolles. (RENAULT).

Stephanian Series.

Locality: Quarry of Foulon. (RENAULT).

Blanzey Coalfield.

Permian.

Locality: Perrecy Colliery, Pit of Romagne, Blanzey. (GRAND' EURY).

¹⁾ Specimens, mentioned in literature, of which we did not see the originals:

Elbstollen, Cotta near Dresden. (GEINITZ, 1862).

Saalhausen near Oschatz. (GEINITZ, 1862).

Walchia-Sandstone, Altenstadt, Wetterau. (GEINITZ, 1862).

Nauheim. (GOEPPERT).

Erbendorf, Oberpfalz. (GÜMBEL).

Todtengraben near Neurode. (GOEPPERT).

Niederrathen. (GOEPPERT).

Near Dresden. (GOEPPERT).

Stephanian Series.

Localities: Découvert Sainte Hélène. (ZEILLER).

Découverts Saint François and Maugrand. (GRAND' EURY).

Loire Coalfield.

Lower Stephanian Series.

Locality: Rive de Gier. (École supér. des Mines, Paris).

Gard Coalfield.

Stephanian Series.

Locality: Quarry Luce. (GRAND' EURY).

Commentry Coalfield.

Stephanian Series.

Localities: Trench of L'Ouest, Shales in the 2^d Seam. (École supér. des Mines, Paris).

Trench of Saint Edmond at 14 m. over the roof of the Grande Couche. (RENAULT).

Commentry. (Mus. Hist. nat., Paris, No. 10733, our Pl. 93, fig. 1).

Southern France.

Stephanian or Permian?

Locality: Sauvebonne near Hyères. (Coll. BRONGNIART, Mus. Hist. Nat., Paris, our Pl. 92, fig. 2; Pl. 96. fig. 3).

CALAMITES JUBATUS L. et H. sp.

Pl. 97; Pl. 98; Pl. 99, fig. 1; Pl. 100, fig. 1, 2; Pl. 156, fig. 1, 2, 3; Pl. 157, fig. 1, 2, 3.

1834 *Asterophyllites jubatus* LINDLEY and HUTTON, Fossil Flora, II, p. 123, Pl. 133.

1850 *Asterophyllites jubatus* UNGER, Gen. and Spec., p. 65.

1851 *Calamites jubatus* ETtingshausen, in HAIDINGER's Naturw. Abh., IV, I, p. 77.

1888 *Asterophyllites longifolius* RENAULT, (pars), Commentry, Atlas, Pl. 48, fig. 1; Text, II, 1890, p. 415.

DESCRIPTION.

Outer surface of stem smooth, finely striated longitudinally. Leaf scars obscure.

Stem slender. Internodes longer than broad or broader than long, attaining a width of 3 cm. or more. Ribs very delicate 0,75 mm. wide and separated by wide straight furrows. Branch and cone scars placed on the nodal line. Branch scars transversely oval, about 4 mm. in diameter.

Foliage verticillate, very long, setaceous, attaining a length of 18 cm. or more, 1 to 2 mm. wide, single veined.

Cones sessile, distichous, and forming two opposite rows, linear lanceolate, about 7 cm. long and 0,5 cm. wide.

REMARKS.

The most perfect specimen of this species is shown on Pl. 97, which has been most generously placed in our hands for description by ZEILLER. The stem is 40 cm. long and is composed of 16 complete and 2 incomplete internodes. The internode at the top of the specimen is 2,8 cm. long and 1,8 cm. wide. The lowest is 1,7 cm. long and 2,7 cm. in width. To the greater number of the nodes the long setaceous foliage is attached and at many of them also the linear sessile cones, whose bracts are much adpressed and seldom show clearly their verticillate arrangement.

The figure on Pl. 97 shows the fossil about two thirds natural size and portions of it are given natural size on Pl. 98, fig. 1, 2, 4, 5, 6. These figures show the fine striation of the internodes and fig. 2 shows especially the attachment of the sessile cones and their structure as far as preserved on the specimen.

A part of the stem is given enlarged two times on Pl. 98, fig. 3. The fine somewhat indistinct ribbing appears to end in a very small tubercle but it is too indistinct to admit of any detailed description. The leaf scars are invariably hidden by a band of coaly matter though at the upper node of fig. 3 are seen faint indications of their presence.

One remarkable character of *C. jubatus* seems to have been the non-resistant nature of the stem to pressure. There cannot have been any large development of wood in the axis for in all the specimens showing its outer surface the stem has collapsed as if it had consisted of a slender tube and shows more or less distinctly the obliquely displaced diaphragms. This is seen on Pl. 98, fig. 2 but is more obvious in the specimen originally described by RENAULT under the name of *Asterophyllites longifolius*, which is refigured on our Pl. 100, fig. 1, 2; fig. 1, fitting on to the top of fig. 2.

A portion of another stem 30 cm. long, is given on Pl. 156, fig. 1. It shows the outer surface, which is very finely striated and at places exhibits indications of the internal ribbing of the cast. It is about 2 cm. wide and shows 9 complete and two incomplete internodes. The internodes are almost of equal length being about 3 cm. long. The most interesting point on this specimen is the very clear manner in which the crushed diaphragms are seen at the nodes. Owing to the presence of the diaphragms at the nodes the stem seems to have retained its full width but towards the centre of the internodes it is contracted and has undergone a certain amount of collapse which clearly shows that there could have been very little development of wood in the axis.

On one of the nodes an oval branch scar can be seen which is about 0,7 cm. long and 0,5 broad.

A portion of a pith cast is given on Pl. 156, fig. 3 and Pl. 157, fig. 1, 2. The specimen is shown natural size on Pl. 157, fig. 1; fig. 2 and Pl. 156, fig. 3, being enlargements of portions of it. The internodes are broader than long, being from 0,30 to 2 cm. long. The upper end of the specimen is 2,9 cm. wide and the base is 3,4 cm. An enlargement given on Pl. 157, fig. 2 shows that the ribs which terminate in very small elongate tubercles are separated by wide furrows. A remarkable feature in *C. jubatus* is that the greater

proportion of the ribs do not alternate at the nodes. Pl. 156, fig. 3 shows the branch scar but except that the ribs are effaced on the part it occupies their course is unaffected by its presence.

A termination of a branch is given on Pl. 99, fig. 1, which is the type of LINDLEY and HUTTON's *Asterophyllites jubatus*.

The specimen, whose complete length is about 23 cm. shows the termination of a stem. The leaves are mostly removed from the base, but even when present the stem can be seen through them. The leaves are very long, setaceous and single veined and although it is difficult to isolate a single leaf for measurement they cannot have been less than 18 cm. long on this specimen. Notwithstanding this great length and their width of only about 1 mm. they maintain an almost upright position, only spreading gently outwards in a fan like manner as they reach the top of the stem and extend beyond it. They must therefore have had a considerable amount of rigidity.

Another termination of a branch is given on Pl. 157, fig. 3. The leaves here are scarcely 1 mm. wide and not less than 12 cm. long and yet they retain an upright position, though they spread out gently as they extend upwards.

Portion of another stem 37 cm. long and which measures 1,7 cm. at the top and 1,9 cm. at the base, is given on Pl. 156, fig. 2. It consists of 9 complete and 2 incomplete internodes, which vary from 1,8 to 5 cm. in length. The shortest internode is immediately above the node which gives off a branch. The length of the internodes from whose summit the cones arise do not appear to show any shortening.

The only species with which the pith casts of *C. jubatus* could be mistaken is *C. cistiiformis* but it is easily distinguished by its very fine delicate ribbing separated by furrows almost as wide as the ribs themselves.

DISTRIBUTION.

Great Britain.

Westphalian Series.

Horizon: Bensham Seam.

Locality: Yarrow, County of Durham. (Pl. 99, fig. 1; "HUTTON Collection," Newcastle-on-Tyne).

Horizon: Low Main Seam.

Locality: Felling Colliery, County of Durham. ("HUTTON Collection," Newcastle-on-Tyne).

Lanarkian Series.

Horizon: Kiltongue or Upper Drumgray Coal.

Locality: Inkerman Pit, Airdrie, Lanarkshire. Collected by R. DUNLOP. (Pl. 156, fig. 2; Coll. KIDSTON, 4831).

Horizon: Shale mined for Alum making.

Locality: The Cleuch, Falkirk, Stirlingshire. (Pl. 156, fig. 1; Coll. KIDSTON, 4832). (Pl. 156, fig. 3; Pl. 157, fig. 1, 2; Coll. KIDSTON, 4833).

Horizon: ?

Locality: Furnace Bank Colliery, Sauchie, near Alloa, Clackmannanshire. Collected by the late Dr. A. E. Grant. (Pl. 157, fig. 3; Coll. KIDSTON, 4468).

France.

Stephanian Series.

Horizon: 8 M. above the roof of the Grande Couche.

Locality: Commentry, Trench of St. Edmond. (RENAULT's Pl. 48, fig. 1; Mus. d'Hist. nat., Paris; our Pl. 100, fig. 1, 2).

Westphalian Series (Upper part).

Horizon: ?

Locality: Mines de Liévin, Pas de Calais. (Pl. 97, Pl. 98; École supér. des Mines, Paris).

CALAMITES ARBORESCENS STERNBERG.

Pl. 104, fig. 2, 3.

1833 *Volkmannia arborescens* STERNBERG, (*pars*), Versuch, II, Fasc. 5, 6, p. 52, Pl. 14, fig. 1.

1872 *Calamites approximatus* FEISTMANTEL, (*pars*), Fruchtstadien, Abh. K. Böhm. Ges. d. Wiss., (6), V, p. 13, Pl. 3.

1876 *Calamites approximatus* FEISTMANTEL, (*pars*), Böhmen, Palaeontogr., XXIII, pp. 106, 107, Pl. 6, fig. 2,

1884 *Calamites arborescens* WEISS, (*pars*), Steink. Calam., II, Abh. z. Geol. Specialk., V, 2, p. 120 (206), (*non* Plates).

1877 *Calamites distachyus* STUR, (*pars*), Culmflora, II, Abh. K. K. geol. Reichsanst., Wien, VIII, 2, pp. 28, 29, 32, (*non* Text fig. 11).

1911 *Calamites distachyus* JONGMANS, (*pars*), Anleitung, I, Mededeel. Rijks Opsporing van Delfstoffen, No. 3, p. 191.

DESCRIPTION.

Stems attaining a width of about 2.5 cm. Internodes shorter than wide, varying from 2 mm. to 1 cm. in length. Ribbing very prominent, alternating at the nodes, though occasionally passing straight over them. Branch scars subcircular, somewhat longer than wide. Umbilicus slightly above the centre and placed on the nodal line. Leaf scars catenulate or subquadrate from mutual pressure.

REMARKS.

The original specimen figured by STERNBERG and the only one known to exist of this species, is shown slightly reduced on Pl. 104, fig. 2 and a portion of it natural size is given at fig. 3. It consists of a stem composed of very short internodes with strong

ribbing, which can be seen at the base of fig. 3. Towards the upper end of the specimen the cortex is partly preserved. The branch scars appear to be borne periodically, but the number on the nodes seems to vary greatly, some nodes showing only one, others two more or less distant, while in one case the scars seem to touch laterally without however causing any deformation from mutual pressure. Owing to the imperfect preservation of the specimen, it is difficult to determine the actual number of internodes which compose the periods but three seem to be a frequent number.

Lying beside the specimen is a branch. This has been usually described as a cone and referred to the stem as its fructification. There has been some mistake here however, as the supposed cone is merely a foliage branch and has no organic connection with the stem beside which it lies. It may possibly belong to it, but there is no proof that such is the case.

Volkmannia arborescens STERNBERG has been united by STUR with *Volkmannia distachya* and with certain stems described by ETTINGSHAUSEN under the name of *C. communis*, (RADNITZ, Pl. 9, 10) all of which he includes under the name of *Calamites distachyus*. (Culmflora, II, p. 28). This identification was accepted by WEISS, (Steink. Calam., II, p. 120), but he named the plant *C. arborescens* although the name *C. distachyus* had a prior claim, *Volkmannia arborescens* having been described by STERNBERG in 1833 and *V. distachya* in 1825. All subsequent authors treating of *Calamites arborescens* or *C. distachyus*, — as both names have been used in later literature, — accept the union of these two species of *Volkmannia* of STERNBERG and have considered the foliage lying beside the stem of *Volkmannia arborescens* STERNBERG as its cone. The only one who questioned the justness of the union of *Volkmannia distachya* STERNBERG with *Calamites arborescens* was STERZEL. (Erl. z. geol. Spezialk. Sachsen., Sect. Zwickau, 2. Auflage, p. 103, 1901).

Volkmannia arborescens and *V. distachya* are however essentially distinct. The stems are entirely different and there is no question of a comparison of the two so called spikes, as the supposed cone of *V. arborescens* is not a cone but a foliage branch whose position beside the stem may be purely accidental. Therefore we treat *V. arborescens* STERNBERG (= *C. arborescens* STERNBERG, non Aut.) and *V. distachya* STERNBERG (= *C. distachyus*) as separate species.

DISTRIBUTION.

Bohemia.

Westphalian Series.

Horizon: Schatzlarer Schichten.

Locality: Svina. (Pl. 104, fig. 2, 3; Böhmisches Landesmuseum, Prag; *Volkmannia arborescens* STERNB.; the other figures mentioned in the synonymy are only copies).

CALAMITES DISTACHYUS STERNBERG.

Pl. 101; Pl. 102.

- 1825 *Volkmannia distachya* STERNBERG, Versuch, I, Fasc. 4, Tentamen, p. XXX, Pl. 48, fig. 3.
1877 *Calamites distachyus* STUR, (pars), Culmflora, II, Abh. K. K. geol. Reichsanstalt, Wien, VIII, 2, pp. 28, 29, 32, Text fig. 11.
1911 *Calamites distachyus* JONGMANS, (pars), Anleitung, I, Mededeel. Rijks Opsporing van Delfstoffen, No. 3, p. 191, (non figures).
1884 *Calamites (Stylocalamites) arborescens* WEISS, (pars), Steink. Calamarien, II, Abh. z. Geol. Specialk., V, 2, p. 120, (Exclude plates).
1854 *Calamites communis* ETTINGSHAUSEN, (pars), Radnitz, Abh. K. K. geol. Reichsanst., Wien, II, 3, 3, p. 24, Pl. 8, fig. 2, 3, (non Pl. 9; non Pl. 10, fig. 2, 3).
1881 *Calamites avec Macrostachya* SAPORTA and MARION, Evolution, Cryptog., p. 141, fig. 57 B, (copied from STUR).

DESCRIPTION.

Stem slender, attaining a width of 1,5 cm. or more, internodes shorter than broad or longer than broad, varying greatly in size even on the same stem. Stems generally contracted at the nodes. Ribbing prominent, frequently not alternating at the nodes. Ribs terminating in blunt points with an obscure tubercle on the upper ends.

Cones distichous, separated by one or more sterile nodes, shortly stalked, length unknown. Bracts spreading, lanceolate with a broad base, extending over three or more internodes. Sporangia numerous, on external surface oblong and arranged as in *Palaeostachya*.

REMARKS.

Two specimens of *C. distachyus* are given on Pl. 101, fig. 1 and Pl. 102, fig. 1. That shown on Pl. 102, fig. 1 is the original type of STERNBERG, which has been refigured by STUR with the various parts spread out in a peculiar manner. The specimen to the left of STUR's text figure is however from another example.

Two cones are seen in organic connection with the stem of STERNBERG's type (Pl. 102, fig. 1) and there seems to be no reason to doubt that in this species the cones were developed distichously, for the nodal line from which these two cones spring is most clearly defined and shows no trace whatever of any scar from which another cone might have been removed. The bracts are much longer and more spreading than those possessed by *C. schulzi* (Pl. 103, Pl. 104, fig. 1). They have much expanded bases and end in sharp points.

A good stem is seen on Pl. 101, fig. 1 of which portions are enlarged at fig. 2, 3. The ribbing is strong and the ribs are divided by wide furrows. The contraction of the nodes is well shown on several parts of this specimen and at the base of the enlargement given at fig. 2. The ribs with their terminal tubercles are seen at the third node from the top on Pl. 101, fig. 2. The enlargements on Pl. 102, fig. 2, 3 also show the strong ribbing of this species.

The fragment of a cone seen towards the centre of Pl. 101, fig. 1 is enlarged at fig. 3. It is partly hidden by a portion of the stem lying over it but exhibits the long bracts with the sporangia sitting in their axils, whose form shows a *Palaeostachya* structure.

DISTRIBUTION.

Bohemia.

Westphalian Series.

Horizon: Schatzlarer Schichten.

Localities: Svina. (STERNBERG, Pl. 48, fig. 3; our Pl. 102; Böhmisches Landesmuseum, Prag;
C. communis ETT., [pars], Radnitz, Pl. 8, fig. 2, 3; K. K. Hofmuseum, Wien).
Kladno. (K. K. Hofmuseum, Wien; Pl. 101).

CALAMITES SCHULZI STUR (*pars*).

Pl. 103; Pl. 104, fig. 1.

- 1884 *cf. Volkmannia crassa* LESQUEREUX, Coalflora, III, p. 719, Pl. 90, fig. 1.
1884 *Calamites (Stylocalamites) arborescens* WEISS, (*pars*), Steink. Calamarien, II, Abh. z. Geol. Specialk., V, 2, p. 120, Pl. 14; Pl. 15; Pl. 16, fig. 1, (? fig. 2); ? Pl. 21, fig. 1, 2; (*non* Pl. 2, fig. 2; Pl. 3, fig. 1; Pl. 8, fig. 3).
1884 *Stylocalamites arborescens* WEISS, Steink. Calamarien, II, Explanation to Plates.
1884 *Palaeostachya arborescens* WEISS, Steink. Calamarien, II, p. 187.
1887 *Calamites schulzi* STUR, (*pars*), Calam. schatzl. Schichten, Abh. K. K. Geol. Reichsanst., Wien, XI, 2, p. 72, Pl. 6, fig. 4; Pl. 7 b, fig. 3, (? 4), (*not* the other figures).
1899 *Calamites distachyus* ZEILLER, (*pars*), Héraclée, Mém. Soc. géol. de France, Paléont., No. 21, p. 60.
1911 *Calamites distachyus* JONGMANS, (*pars*), Anleitung, I, Mededeel. Rijks Opsporing van Delfstoffen, No. 3, p. 191, fig. 160, (*non* fig. 159).
1901 *Calamites arborescens* STERZEL, (*pars*), Palaeont. Charakter Zwickau, Erläut. zur geol. Spezialk. Sachsen, Sect. Zwickau, 2. Aufl., p. 103.
1874 *Calamites suckowi* BGT., mit *Huttonia carinata* GERM., FEISTMANTEL, Böhmen, Palaeontogr., XXIII, Pl. 9.

DESCRIPTION.

Stem attaining a width of 3 cm. or more, not contracted at the nodes. Internodes broader than long, feebly ribbed, ribs alternating at the nodes, but occasionally they pass straight over them without any alternation. Terminations of ribs and tubercles obscure.

Cones verticillate, shortly stalked, four in a whorl, sometimes occurring on every node, sometimes separated by one or more sterile nodes. Stalk about 1 to 1,5 cm. long. Cones linear, elongate, 20 cm. or more long, 2 cm. wide, composed of 35 or more short internodes of about 0,5 cm. long. Bracts narrow, lanceolate, with sharp points, extending over two internodes. Position of sporangia uncertain.

REMARKS.

The specimens included here under *C. schulzi* have been mostly united by previous authors with *C. arborescens* and *C. distachyus* but for reasons already given we treat *C. arborescens* STERNBERG (*non* Aut.) as a distinct species.

What we therefore have to deal with here are the cones which have been variously united by authors with *C. arborescens* and *C. distachyus*. Among these we believe are two species which have been united in error. One of these is the *Calamites distachyus* STERNBERG (*non* Aut.) and the other the stems with cones attached which have been described by STUR as *C. schulzi*, and by WEISS as *C. arborescens*.

C. schulzi as here limited, (for remarks on the other figures given under this name by STUR see *C. undulatus* p. 32,) is distinguished from *C. distachyus* by the less prominent ribbing of the stems which also do not show any constriction at the nodes, and by its cones being developed in verticils of four with short adpressed bracts.

We exclude from *C. schulzi* all the specimens referred to *C. arborescens* by WEISS which do not show the cones as we do not think that these specimens offer sufficient data for their satisfactory reference to *C. schulzi*.

We also exclude the *Palaeostachya arborescens* of WEISS, Pl. 16, fig. 2, which shows a few nodes of a cone bearing *Palaeostachya*-sporangia, as it is impossible to affirm that this fragment really belongs to the species with which he identifies it.

Palaeostachya schimperiana WEISS, does not appear to be identifiable with *C. schulzi* as suggested by WEISS, as the form of the basal parts of the bracts seems to be too broad and the whole character of the cone itself is different from those of *C. schulzi*.

We unite here however *Volkmannia crassa* LESQUEREUX as we cannot observe any character by which it can be separated from *C. schulzi*. If this opinion be correct, — a view which can only be settled by an examination of authentic specimens, — then the name of *C. schulzi*, according to the law of priority, must give place to that of *C. crassus* LESQUEREUX. We also unite here the "*Calamites suckowi* BGT. mit *Huttonia carinata* GERMAR" of FEISTMANTEL.

The fertile specimens from Héraclée, mentioned by ZEILLER, belong to this species.

A large specimen of *C. schulzi* is shown on Pl. 103. The two figures are parts of the same example, the lowest node shown in fig. 1 corresponding with the sixth node from the top of fig. 2. On the ninth node from the top of fig. 2 a cone is seen to spring from each side of the stem, on whose exposed surface, midway between them, is seen the scar of the third cone of the verticil, the fourth one having been at the opposite side of the stem. The stem is not very well preserved and only in few cases can the scars of the missing cones be observed.

The invariably closely adpressed bracts are well seen, on this and on the other specimen, given on Pl. 104, fig. 1 (Original of STUR's Pl. 7b, fig. 3). This latter specimen also shows well the non-constricted nodes of the stem and both show the feeble ribbing of the internodes.

C. schulzi although undoubtedly a rare plant has a remarkably wide distribution.

DISTRIBUTION.

Héracleé Coalfield, Minor Asia.

Westphalian Series.

Horizon: Faisceau des couches 2 à 14.

Locality: Coslou. (ZEILLER; École supér. des Mines, Paris).

Austria.

Westphalian Series.

Schatzlarer Schichten.

Horizon: Seam "50-zölliges Flötz."

Locality: Schatzlar. (*C. schulzi* STUR's Pl. 6, fig. 4).

Germany.

Lower Silesia.

Westphalian Series.

Schatzlarer Schichten.

Horizon: ?

Localities: Ruben Colliery near Neurode. (WEISS, Geol. Landesanstalt, Berlin; *C. schulzi* STUR's Pl. 7b, fig. 3, our Pl. 104, fig. 1; Zwinger Museum, Dresden, our Pl. 103).

Carl Georg Victor Colliery near Neu Lässig.

United States America.

Series?

Horizon: ?

Locality: Dade County, Georgia. (LESQUEREUX).

CALAMITES CARINATUS STERNBERG.

Pl. 66, fig. 5; Pl. 104, fig. 5; Pl. 105; Pl. 106, fig. 1, 2, 3, 4; Pl. 107, fig. 1; Pl. 108, fig. 1, 2;
Pl. 156, fig. 6; Text fig. 69.

1824 *Calamites carinatus* STERNBERG, Versuch, I, Fasc. 3, p. 36, 39, Pl. 32, fig. 1; Fasc. 4, 1825, Tentamen, p. XXVII.

1825 *Calamites ramosus* ARTIS, Antedil. Phytol., Pl. 2.

1828 *Calamites ramosus* BGT., Histoire, I, p. 127, Pl. 17, fig. 5, (? 6).

1828 *Calamites ramosus* BGT., Prodrôme, p. 37.

1835 *Calamites ramosus* GUTBIER, Zwickau, p. 18, ? Pl. 2, fig. 6.

1845 *Calamites ramosus* UNGER, Synopsis, p. 21.

1848 *Calamites ramosus* SAUVEUR, Belgique, Pl. 9, fig. 2, 3; (? Pl. 10, fig. 1, 2).

1848 *Calamites ramosus* GOEPPERT, in BRONN, Index palaeont., p. 199.

1850 *Calamites ramosus* MANTELL, Pictorial Atlas, Pl. 13.

1850 *Calamites ramosus* UNGER, Gen. et spec. p. 45.

1869 *Calamites ramosus* VON ROEHL, Westphalen, Palaeontogr., XVII, p. 10, (non Pl. 1, fig. 3, non fig. 4).

- 1879 *Calamites ramosus* ZEILLER, Explic. de la Carte géol. de la France, IV, 2, (1880, Végét. foss. du terr. houill.), p. 15.
- 1879 *Calamites ramosus* LESQUEUREUX, Coalflora, (Atlas, ? non Pl. 1, fig. 2, non fig. 3), (non Vol. III, 1884, Pl. 92, fig. 1—4); Text, I, 1880, p. 22.
- 1881 *Calamites ramosus* WEISS, Aus d. Steinkohlenf., p. 10, Pl. 8, fig. 44, (Ed. II, 1882, Same figure).
- 1882 *Calamites ramosus* RENAULT, Cours, I, p. 163, Pl. 24, fig. 9, (non fig. 8, Restoration).
- 1883 *Calamites ramosus* SCHENK, (pars), in RICHTHOFEN, China, IV, Pl. 39, (Stem only).
- 1884 *Calamites ramosus* WEISS, (pars), Steink. Calam., II, Abh. z. Geol. Spezialk., V, 2, p. 98, (? Pl. 2, fig. 3); Pl. 5, fig. 1, 2; Pl. 6; Pl. 7, fig. 1, (non fig. 2); (? Pl. 8, fig. 1, 2, 4); Pl. 9, fig. 1, (? fig. 2); Pl. 10, fig. 1; Pl. 20, fig. 1, 2.
- 1886 *Calamites ramosus* ZEILLER, (pars), Valenciennes, Atlas, Pl. 56, fig. 3; (non Pl. 55, fig. 3); Text, 1888, p. 345.
- 1887 *Calamites ramosus* STUR, (pars), Calam. Schatzl. Schichten, Abh. K. K. Geol. Reichsanst., Wien, XI, 2, p. 96, Pl. 12, fig. 1—4, (non fig. 5, 6); Pl. 12b, fig. 1—4, (non 5), 6; (? Pl. 13, fig. 1—9); (? Pl. 14, fig. 3—5); Text fig. 29, 30, 31, (non 1, 2, non 28, 32).
- 1888 *Calamites ramosus* TOULA, Die Steinkohlen, p. 205, Pl. 5, fig. 24; (Pl. 6, fig. 7, Restoration).
- 1897 *Calamites ramosus* CREDNER, Elem. d. Geologie, 8. Auflage, p. 453, fig. 250.
- 1901 *Calamites ramosus* KIDSTON, Flora Carbon. Period, Proc. Yorksh. Geol. and Polyt. Soc., XIV, p. 201, 229, Pl. 37, fig. 3, 4.
- 1903 *Calamites ramosus* KIDSTON, Canonbie, Trans. Roy. Soc. Edinburgh, XL, Pt. IV, p. 790.
- 1910 ? *Calamites ramosus* RENIER, Docum. Paléont. terr. houill., p. 17, Pl. 40.
- 1911 *Calamites ramosus* JONGMANS, Anleitung, I, Mededeel. Rijks Opsporing van Delfstoffen, No. 3, p. 115, fig. 110, 111, 112, (non fig. 113, 114, 115).
- 1911 *Calamites ramosus* KIDSTON, Hainaut, Mém. Mus. Roy. Hist. nat. de Belgique, IV, p. 108.
- 1913 *Calamites ramosus* JONGMANS and KUKUK, Calam. Rhein. Westf. Kohlenb., Mededeel. Rijks Herbarium, Leiden, No. 20, p. 36, Pl. 12, fig. 5.
- 1884 *Eucalamites ramosus* WEISS, Steink. Calamarien, II, in explanation to plates.
- 1823 *Calamites nodosus* STERNBERG, (non SCHL.), Versuch, I, Fasc. 2, pp. 27, 32, Pl. 17, fig. 2; Fasc. 4, 1825, Tentamen, p. XXVII; II, Fasc. 5, 6, 1833, p. 48.
- 1832 *Calamites nodosus* L. et H., (non SCHL.), (pars), Fossil Flora, I, Pl. 15, fig. 1, (Stem only); (non fig. 2; non Pl. 16).
- 1877 *Calamites nodosus* LEBOUR, (non SCHL.), Illustrations, pp. 3, 7, Pl. 2; (? Pl. 3).
- 1854 *Calamites communis* ETTINGSHAUSEN, (pars), Radnitz, Abh. K. K. Geol. Reichsanst., Wien, II, 3, 3, p. 24, ? Pl. 3, fig. 2; Pl. 4, (non fig. 2), fig. 4.
- 1862 *Calamites communis* var. *ramosus* STUR, Jahrb. d. K. K. Geol. Reichsanst., Wien, XII, Sitzungsberichte, pp. 141, 142.
- 1868 *Calamites cannaeformis* VON ROEHL, (non SCHL.), (pars), Westphalen, Palaeontogr., XVII, ? Pl. 1, fig. 5; (non Pl. 1, fig. 2, 8a; non Pl. 22, fig. 1).
- 1881 *Calamites cannaeformis* ACHEPOHL, (non SCHL.), Westf. Steink., p. 34, Pl. 8, fig. 3.
- 1865 *Calamites cisti* HEER, (non BGT.), (pars), Urwelt der Schweiz, p. 8, ? fig. 4a, (non 4b).

DESCRIPTION.

Outer surface of cortex smooth. Internodes almost invariably longer than broad, attaining a length of 14 cm. or more with a width of 10 cm.

Pith cast ribbed, ribs flattened, alternating at the nodes with a terminal, oval tubercle, which is however extremely rarely seen. Ribs separated by a wide double lined furrow, surface faintly striated longitudinally. Branch scars oval-triangular, attain-

ing a diameter of 2,5 cm. or more with a large central opening. Ribs bending towards each other at the margin of the central opening and forming little fan shaped groups of two to four ribs. Two opposite branch scars are placed on each node but the scars of succeeding nodes are not directly over one another. The two opposite branches of one node stand directly over the branches of the second node below them, the branches of the alternate nodes springing from the stem a little to the right or left of those below and above them. (Seen in Text fig. 69).

The nodes rarely bear a single scar or three scars.

Foliage of the *Annularia* type, cones belong to the Genus *Calamostachys*.

REMARKS.

Several names have been applied to this Calamite by various authors. The name generally accepted being that of *Calamites ramosus* ARTIS, but two other names are older viz. *C. nodosus* and *C. carinatus*. The name *C. nodosus* was first employed by SCHLOTHEIM (Petrefactenk., p. 401, Pl. 20, fig. 3, 1820), but his figure is absolutely indeterminate. STERNBERG (Versuch, I, Fasc. 2, 1823, p. 27, 32) also used the name of *C. nodosus* and unites SCHLOTHEIM's *C. nodosus* and *C. gibbosus* (l. c. Pl. 20, fig. 1, 3) with his own specimen, which he figures on Pl. 17, fig. 2. The original of this figure is still in the collection of the Bohemian Museum at Prague and most probably is specifically identical with the *C. ramosus* of ARTIS. As however the original figure given by SCHLOTHEIM is absolutely indeterminate and is certainly not the *C. ramosus* ARTIS, the name *C. ramosus* ARTIS could therefore be retained and the *C. nodosus* of STERNBERG (*non* SCHLOTHEIM, *non* BGT.) be reduced to a synonym of *C. ramosus* ARTIS. The figures published under the name *C. nodosus* by LINDLEY and HUTTON, and LEBOUR could also be considered as synonyms of *C. ramosus* ARTIS.

STERNBERG however in 1824 (Versuch, I, Fasc. 3, p. 36, 39, Pl. 32, fig. 1) described another specimen under the name of *C. carinatus*. This specimen according to the figure, certainly belongs to the same species as *C. ramosus* ARTIS. Unfortunately the original specimen cannot be traced. According to BRONGNIART (Hist., p. 128), STERNBERG's figure was believed to have been produced from a drawing sent to him by BUCKLAND and BRONGNIART gives a figure of *C. ramosus* said to be from a drawing of the same specimen. If so, one of the drawings must have been very inaccurate. STERNBERG however says that his specimen came from Radstock near Bath, Somersetshire, and does not mention BUCKLAND's name in connection with it (STERNBERG, l. c., Fasc. 3, p. 39). Further it may be noted that BRONGNIART gives his specimens as from Yorkshire, an entirely different locality. As however there can be no doubt that STERNBERG's *C. carinatus* is specifically identical with the *C. ramosus* of ARTIS, according to the laws of priority the name *C. ramosus* must give place to that of *C. carinatus* STERNBERG, which was created a year sooner.

A good specimen of *C. carinatus* is given on Pl. 107, fig. 1. It shows a node bearing a large branch scar. The ribs bend over the margin and run together in little

groups of two or three, which give the pith cavity the appearance of a many pointed star. This specimen also shows very distinctly, especially immediately below the branch scar, the double bordered furrow which separates the ribs.

Another specimen is given on Pl. 105, fig. 2 on which the form of the scar is really more characteristic than that seen on the last specimen and is oval-triangular. The confluence of the ribs on its margin is not so clearly seen as on the first example. At the upper ends of the ribs the oval tubercles are visible, a structure, which is extremely seldom seen on the ribs of *C. carinatus*. The double lined furrows are also very well exhibited.

The two sides of a small pith cast removed from its matrix are given on Pl. 108, fig. 1, 2. It shows two opposite scars on each node and that only the scars of each alternate node stand above each other as illustrated in Text fig. 69.

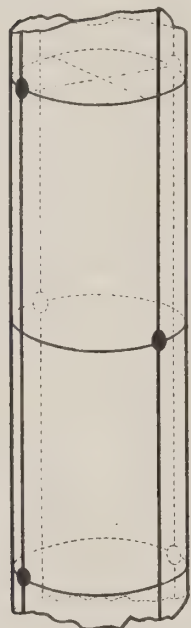


Fig. 69.

Calamites carinatus STERNB.
Diagram of specimen shown on Pl. 108, fig. 1, 2.

On Pl. 66 at fig. 5, an impression is shown of a slightly distorted branch scar which however shows very clearly the converging ribs on its margin and the finely striated surface of the ribs.

The specimen given on Pl. 104, fig. 5 shows the pith cast of the branch entirely filling up the scar of the stem cast.

Very seldom one meets with specimens of large size that show a complete internode and the longest complete one that we have seen is that figured on Pl. 105, fig. 3, which measures 14,5 cm.

The scar given on the specimen seen on Pl. 106, fig. 2 has one margin of the scar much wider than the other, though it still has a pith cast cavity of over 1 cm. in diameter and the same characters are seen in the specimen with the small branch scar given on Pl. 105, fig. 4.

Fig. 1 and 3 of Pl. 106 show the two sides of a small specimen removed from the matrix whose node bears only one branch scar (var. *monobrachiatus* of WEISS). The nodal line at fig. 1 illustrates the characteristic behaviour of the ribs at the nodes. Through a slight constriction of the nodal line the ribs bend slightly inward and are often less flattened along this narrow band, which adds a certain amount of prominence to their extreme upper and lower portions.

One side of a specimen with three branch scars (var. *tribrachiatus* of WEISS) is seen on Pl. 106, fig. 4. The third branch scar occurs on the opposite side midway between the two scars seen on the figure.

One stem giving rise to another is illustrated at fig. 1, Pl. 105. On the internode above that from which the stem arises, at the right extremity of the nodal line, the remains of another scar are seen. The ribbing seems to be much finer on the internode below that from which the stem arises and the stem may here be assuming a rhizomatic condition.

The only specimen of *C. carinatus* which shows the outer surface of the bark is given on Pl. 156, fig. 6. It shows three nodes to the lower of which a branch is still attached. At the base this branch is 9 mm. wide and its first internode is 9 cm. long.

The internodes of the stem are respectively 7 and 6 cm. long. The cortex bears numerous very short striae and at the nodes the ribbing is feebly seen.

C. carinatus differs from the variety *rugosus* in having a smooth bark and from *C. paleaceus* also by its smooth bark but chiefly by the form of the branch scars which have a large central pith cavity and on stems of corresponding size are always larger than those of *C. paleaceus* STUR.

DISTRIBUTION.

Great Britain.

Radstockian Series.

Horizon: Radstock Group.

Localities: Radstock, Somersetshire.

Camerton, Somersetshire.

Horizon: Farrington Group.

Locality: Farrington Pit, Farrington Gurney, Somersetshire.

Horizon: Mynyddislwyn Seam.

Locality: Gelli-deg Level, Maes-y-Cwmmer, Monmouthshire, S. Wales. (Geol. Survey, London).

Horizon: Four feet Seam of Swansea.

Locality: Caennewydd Colliery, near Gowerton Station, Glamorgan, S. Wales. (Geol. Survey, London).

Locality: Gladys Colliery, near Penllergare Church, Glamorgan, S. Wales. (Geol. Survey, London).

Horizon: Red Beds.

Localities: Barony Pit, Oldbyres Farm, near Auchinleck, Ayrshire.

Cessnock Water, Mauchlin, Ayrshire. Collected by J. SMITH.

Staffordian Series.

Horizon: New Rock Group, Thoroughfare Seam.

Locality: Kingswood near Bristol, Somersetshire.

Horizon: Strata between Wenallt Seam and No. 2 Rhondda Seam.

Locality: Glassbrooks Shaft, near Cadoxton Village, Glamorganshire. (Geol. Survey, London).

Horizon: No. 1 Rhondda Seam.

Locality: Tip near Pont-y-geifr Farm, near Resolven Station, Glamorganshire. (Geol. Survey, London).

Horizon: Black Band Group, Bassy Mine Ironstone.

Locality: Stafford Iron and Coal Company, Fenton, North Staffordshire.

Horizon: Black Band Group. Above Bradford Four Feet Coal.

Locality: New Sinking, Bradford Colliery, Manchester.

Westphalian Series.

Common. (The figured specimens only are mentioned here).

Horizon: Below Black Bed Coal.

Locality: Dolly Lane, Leeds, Yorkshire. (Pl. 105, fig. 1; Pl. 156, fig. 6).

Lanarkian Series.

Common. (The lowest occurrences only are mentioned here).

Horizon: Near Base of Coal bearing Group.

Locality: Blairpoint, Dysart, Fife.

Horizon: Elland Flags.

Locality: Ringby near Halifax, Yorkshire.

Horizon: Millstone Grit, Gwespys Sandstone.

Locality: Bulcocks Quarry, Gwespys Village, Flintshire, N. Wales.

Horizon: ?

Locality: Furnace Bank Pit, Sauchie near Alloa, Clackmannanshire. (Pl. 106, fig. 1, 2, 3).

Horizon: ?

Locality: Devonside near Alloa. (Pl. 108, fig. 1, 2.)

Netherlands.

Westphalian Series.

Equivalent of the Lower "Gaskohle" and "Fettkohle" of the Rheno Westfalian Coalfield.

Frequent in the different borings in Southern Limburg and in the Peel Coalfield.

Equivalent of the Lower "Fettkohle" of the Rheno Westfalian Coalfield.

Horizons: Under Seam IV; Seam V, (Pl. 105, fig. 2, 3); Seam VIII.

Locality: Wilhelmina Colliery, near Heerlen, Limburg.

Horizon: Seam V.

Locality: Oranje Nassau I Colliery, Heerlen.

Horizons: Seam V; Seam VIII, (Pl. 106, fig. 4).

Locality: Laura en Vereeniging Colliery, near Heerlen.

Horizon: Seam Senteweck.

Locality: Dominiale Mijn, Kerkrade, near Heerlen.

France.

Bassin du Nord.

Westphalian Series.

Common. (Figured specimens only are mentioned here).

Horizon: Seam Delloye.

Locality: Aniche, Pit Notre Dame. (Pl. 107, fig. 1).

Pas de Calais.

Westphalian Series.

Common.

Horizon: Seam "Nouvelle Veine du Nord".

Locality: Lens Collieries, Pit No. 1. (ZEILLER).

Loire Coalfield.

Stephanian Series.

Horizon: ?

Locality: Saint Etienne. (Mus. Hist. Nat., Paris; Pl. 104, fig. 5).

Belgium.

Westphalian Series.

Common.

Hainaut vide KIDSTON, 1911; Mariemont Collieries from different Pits and Horizons in the Coll. DELTENRE.

Horizon: Seam Grande Pucelle.

Locality: Colliery of Sart d'Avette. (Coll. RENIER).

Horizon: ?

Locality: Nord du Flénu Colliery. (Musée houiller, Louvain).

Horizon: Seam Exhauze.

Locality: Bascoup Colliery, Pit Sainte Cathérine. (RENIER's Pl. 40, 1910).

Germany.

Westphalian Series.

Rheno Westfalian Coalfield.

Vide JONGMANS and KUKUK, 1913.

Niederrhein.

Horizon: Shales at 715—730 M.

Locality: Boring 58, in Appeldorn. (Geolog. Landesanst., Berlin).

Upper Silesia.

Muldegruppe.

Horizon: Shales at 627 and 669 M.

Locality: Boring Borin I, near Timmensdorf. (Geolog. Landesanst., Berlin).

Horizon: Leopold Seam.

Locality: Orzesche. (STUR's Pl. 12, fig. 4; Pl. 12 b, fig. 1).

Lower Silesia.

Schatzlarer Schichten.

Horizon: ?

Locality: Ruben Colliery near Neurode. (WEISS, 1884).

Horizon: Seam VII.

Locality: Neurode. (STUR's Pl. 12 b, fig. 2, 3, 4, 6).

Austria.

Westphalian Series.

Schatzlarer Schichten.

Horizon: Seam "50-zöll. Flötz".

Locality: Schatzlar. (STUR's Pl. 12, fig. 2, 3).

Bohemia.

Stephanian Series, (Ottweiler Schichten).

Horizon: ?

Locality: Kotikov. (Historisches Museum, Pilsen).

Stephanian Series (Lower Part) or Westphalian Series (Highest Part).

Horizon: ?

Localities: Nurschan, Cervený Ujezd (Rothaujerd), Tremoina, Trnova.

Kaolingruben in Zaluzi near Pilsen.

Maria Pit and Frischglück Pit near Pilsen.

(The specimens are in the Historisches Museum, Pilsen).

Westphalian Series.

Horizon: ?

Locality: Radnitz. (ETTINGSHAUSEN's C. communis, 1845, Pl. 4, fig. 4).

Minor Asia.

Westphalian Series.

Horizon: Faisceau des couches 1 à 14.

Locality: Coslou. (ZEILLER; our Pl. 105, fig. 4).

CALAMITES CARINATUS STERNBERG.

VAR. RUGOSUS KIDSTON et JONGMANS.

Pl. 41, fig. 1, 2, 3; Pl. 155, fig. 1.

1913 *Calamites ramosus* var. *rugosus* KIDSTON et JONGMANS, in JONGMANS and KUKUK, Calam. Rhein. Westf. Kohlenbecken, Mededeel. Rijks Herbarium, Leiden, No. 20, p. 38, Pl. 13, fig. 1, 2, 3.

DESCRIPTION.

Pith cast as in *C. carinatus*, branch scars large, with a large central opening, in which the matrix of the rock is exposed.

Outer surface densely ornamented with rugose irregular transversely elongated apiculate elevations.

REMARKS.

The pith casts and branch scars of this variety are identical with those of *C. carinatus* and the variety only differs from the type in its ornamentation of the outer surface of the cortex.

On Pl. 41, fig. 1, 2, 3, three specimens are figured all showing the characteristic ornamentation of the outer surface and portions of the cortex are seen lying beside the pith cast on Pl. 155, fig. 1. On the upper node of this specimen two branch scars are seen, on the lower only one is present (? var. *tribrachiatatus* of WEISS).

The small specimen shown on Pl. 41, fig. 3 exhibits the elongated tubercles both at the upper and lower ends of the ribs.

DISTRIBUTION.

Great Britain.

Westphalian Series.

Horizon: Shale over Barnsley Thick Coal. (Same Horizon as type of *C. ramosus* of ARTIS).

Locality: Woolley Colliery, Darton near Barnsley, Yorkshire, Collected by W. HEMINGWAY. (Pl. 155, fig. 1).

Germany.

Westphalian Series.

Horizon: Gassflammkohle.

Locality: Piesberg near Osnabrück. (Pl. 41, fig. 1, 2, 3; Geol. Landesanstalt, Berlin).

CALAMITÈS CARINATUS STERNBERG.

VAR. A.

Pl. 118, fig. 1.

DESCRIPTION.

Internodes long, attaining a length of 12 or more cm. with a width of about 8 cm., ribbing as in *C. carinatus*. Branch scars smaller than in the type, borne on each node and having a large central pith opening. Ribs converging on margin of branch scars as in the type.

REMARKS.

This variety differs from the type in the smallness of the branch scars in proportion to the size of the stem.

DISTRIBUTION.

Westphalian Series.

Netherlands.

Horizon: Seam VIII.

Locality: Wilhelmina Colliery near Heerlen, Limburg. (Pl. 118, fig. 1).

CALAMITES CARINATUS STERNBERG.

VAR. B.

Pl. 116, fig. 3.

1848 *Calamites artisii* SAUVEUR, (*pars*), Belgique, Pl. 7, fig. 3.

DESCRIPTION.

Scar almost circular to which many of the ribs converge. Pith cast narrow, much constricted at the nodes and bordered by an impression of a wide wood zone. Ribbing as in the type.

REMARKS.

The pith cast is about 3 cm. wide but does not show any complete internode. It is very prominently constricted at the node which bears a single circular scar, 8 mm. in diameter, with a very large pith opening. The specimen differs from the type chiefly in the much constricted nodes and in the presence of the thick wood zone which however may be the fortuitous result of preservation.

The figure published by SAUVEUR on his Pl. 7, fig. 3 under the name of *C. artisii* belongs to the same form. (*C. artisii* SAUVEUR Pl. 7, fig. 1, 2 may belong to *C. suckowi* and Pl. 8, fig. 2 might be a small specimen of *C. carinatus*).

DISTRIBUTION.

Belgium.

Westphalian Series.

Horizon: Seam Ficelle.

Locality: Mariemont Collieries, Pit Réunion. (Pl. 116, fig. 3; Coll. DELTENRE).

CALAMITES ARTISI RENAULT (*non* SAUVEUR).

Pl. 129, fig. 2, 3.

1888 *Calamites artisi* RENAULT, (*non* SAUVEUR), Commentry, p. 391, Pl. 44, fig. 3.

DESCRIPTION AND REMARKS

The specimen figured by RENAULT under the above name is reproduced on our Pl. 129, fig. 2, 3. The original is very badly preserved but not so imperfect as represented in RENAULT's figure.

The internodes vary in length from 3,8 cm. to 9,8 cm. and their ribs show a tendency to run together in groups at the nodal line. The ribs are straight and are divided by a double lined furrow. The central node shows a circular scar about 0,5 cm. in diameter. An enlargement of the ribs, which are finely striated longitudinally, is given at fig. 3. It is extremely probable that this specimen represents an abnormal example of *C. carinatus* to which species also some of SAUVEUR's original specimens of *C. artisii* may belong.

DISTRIBUTION.

France.

Stephanian Series.

Horizon: In sandstone below the "Grande Couche".

Locality: Commentry, Trench of Forêt.

CALAMITES PALEACEUS STUR.

Pl. 66, fig. 6; Pl. 67, fig. 1; Pl. 81, fig. 1; Pl. 108, fig. 3, 4, 5; Pl. 109; Pl. 110; Pl. 111; Pl. 112; Pl. 113, fig. 1, 2; Pl. 114, fig. 4; Pl. 115, fig. 1; Pl. 116, fig. 2; Pl. 155, fig. 2, 3.

1887 *Calamites paleaceus* STUR, Calam. schatzl. Schichten, Abh. K. K. Geol. Reichsanstalt, Wien, XI, 2, p. 116, Pl. 11b, fig. 1, 2, 3.

1911 *Calamites paleaceus* JONGMANS, Anleitung, I, Mededeel. Rijks Opsporing van Delfstoffen, No. 3, p. 121, fig. 117.

1911 *Calamites paleaceus* KIDSTON, Hainaut, Mém. Mus. Roy. Hist. nat. de Belgique, IV, p. 110, Pl. 10, fig. 1-4; Text fig. 16-19.

- 1913 *Calamites paleaceus* JONGMANS and KUKUK, Calam. Rhein. Westf. Kohlenbecken, Mededeel. Rijks Herbarium, Leiden, No. 20, p. 39, Pl. 12, fig. 6; Pl. 14, fig. 1; Pl. 15, fig. 1.
- 1884 *Calamites ramosus* WEISS, (non ARTIS), (pars), Steinkohlen Calam., II, Abh. Geol. Spezialkarte, V, 2, p. 98, (? Pl. 2, fig. 3; ? Pl. 7, fig. 2).
- 1886 *Calamites ramosus* ZEILLER, (non ARTIS), (pars), Valenciennes, Atlas, Pl. 55, fig. 3; (non Pl. 56, fig. 3); Text, 1888, p. 345.
- 1899 *Calamites (Eucalamites) ramosus* HOFMANN and RYBA, (non ARTIS), Leitpflanzen, p. 25, (? Pl. 1, fig. 8).
- 1904 *Calamites (Eucalamites) ramosus* ARBER, (non ARTIS), Phil. Trans. Roy. Soc. London B, Vol. CXC VII, p. 301, Pl. 19, fig. 2.
- 1868 *Selaginellites erdmanni* VON ROEHL, (non GERMAR), (pars), Westphalen, Palaeontogr., XVIII, Pl. 24, fig. 4.

DESCRIPTION.

Outer surface of stem.

Stem attaining a width of 12 cm. or more, with internodes of 21 cm. or more long.

Outer surface of cortex bearing more or less numerous scattered apiculae with frequently little irregular connecting ridges, often however very sparsely produced. On the smaller branches the ornamentation sometimes assumes a granular appearance.

Branch scar circular, placed on the nodal line and showing faint indications of the ribs converging to its centre.

Pith cast.

Ribbed. Ribs longitudinally striated. Tubercles not observed. Ribs separated by a double lined furrow and at the node sometimes converge towards one another. Branch scars circular or transversely oval, attaining a diameter of 2 cm. or more and form mamillaeform depressions down whose sides the gradually narrowing ribs extend, meeting in the centre of the scar and leaving only a very small opening for the pith.

Stem leaves setaceous, free, 2 cm. long. Branch leaves of the *Asterophyllites* type. Cone of the type of *Volkmannia pseudosessilis* GRAND' EURY.

ROOTS.

Myriophyllites gracilis ARTIS.

REMARKS.

A number of figures are given to show the outer surface of the stem and the variation in its ornamentation. The most extreme form of ornamentation is that where the outer surface of the cortex becomes thickly covered with an apiculate-reticulate form of marking as seen on STUR's Pl. 11 b, fig. 1. A similar condition is shown on our Pl. 155, fig. 3. This particular form of surface ornamentation is practically identical with that found in the *var. rugosus* of *C. carinatus*, and it might be impossible to sepa-

rate small portions of the cortex of *C. paleaceus* from fragments of the bark of *C. carinatus* var. *rugosus*.

At fig. 2, Pl. 109 there is also seen a portion of a stem on which this type of ornamentation is exhibited but it does not extend over the whole internode, assuming a more apiculate form on certain parts. This specimen also shows the ribbing shadowed through the bark.

At fig. 1 of the same plate another specimen shows a very similar ornamentation on its lower portion. The upper internode is perfectly smooth and this may have resulted from decay of the outer surface. A portion of this part of the cast is shown enlarged at fig. 3 and illustrates very clearly the double lined furrows and the longitudinally striated surface of the ribs.

That variety of ornamentation which consists of scattered apiculae without reticulate connecting ridges is given on Pl. 115, fig. 1. One sees here, especially on the lower part of the fossil the ribbing of the cast shadowed through the bark which also shows most beautifully the double lined furrows between the ribs. From the fact that one so frequently sees the ribbing shadowed through the outer surface of the stem it is legitimate to infer that the cortex must have been thin.

On the specimen given at fig. 1, Pl. 67 the ornamentation consists of comparatively few and inconspicuous apiculae but probably this example has undergone a certain amount of decay as the ribbing is exceptionally distinct. At the lower end however the fine apiculate ornamentation is very distinctly seen but here the ribbing is not visible.

A small specimen showing the characteristic surface marking of the apiculate type is given on Pl. 113, fig. 1. The ribs are also here shadowed through the cortex.

Another example showing a very sparse reticulation of the outer surface is seen on Pl. 114, fig. 4.

On the younger stems the ornamentation takes the form of a granular structure with very closely placed small apiculae. One such example is seen on Pl. 112, fig. 2 and a part of the impression is given at fig. 2, Pl. 110. The scar shown at the uppermost node of the specimen on Pl. 112, fig. 2 is imperfectly preserved but on several portions of the cortex the fine granular apiculae are distinctly observable though perhaps they are represented with greater distinctness on the counterpart seen at fig. 2, Pl. 110.

A somewhat similar specimen is given on Pl. 116, fig. 2, which not only shows the fine granular ornamentation of the cortex but also the best impression of the branch scar we have seen on the outer surface of the bark. The surface of the scar is marked by the fine radiating extremities of the ribs which meet in the centre around a small dark spot, about 2 mm. in diameter, which probably represents the small healed scar of the pith cavity of the branch.

A still younger example is given on Pl. 110, fig. 3, where the ornamentation consists only of fine apiculae.

A small fragment showing the combination of the coarse apiculate and the fine granular ornamentation is seen on Pl. 111, fig. 3.

The form of the typical scar on the pith cast is shown on Pl. 108, fig. 3. The ribs are seen to gradually narrow and extend over almost the whole surface of the mamillate scar, leaving only a small central opening for the pith of the branch, of about 1 mm. in diameter. Through slight distortion the pith opening appears to be here somewhat eccentrically placed but normally it occupies the centre of the scar. At fig. 4 of the same plate another scar is seen, which also shows the pith opening to be of very small size. The double lined furrows which divide the ribs are exceedingly well shown on this specimen.

Other small fragments showing a scar almost identical to that just described are given on Pl. 66, fig. 6 and Pl. 110, fig. 4.

A very fine branch scar, in which one sees the creeping over of the ribs down its inner surface and their meeting towards the centre is figured on Pl. 112, fig. 3. The double lined furrow dividing the ribs is also very distinct on this specimen.

Another fine branch scar showing also the ribs extending over its margin is given on Pl. 155, fig. 2.

Larger branch scars are seen on the specimens given on Pl. 81, fig. 1, Pl. 111, fig. 2 and Pl. 112, fig. 1. That shown on Pl. 81, fig. 1 shows a larger pith opening than those already described, being about 0,5 cm. wide but this unusual size arises through the base of the scar being filled with the matrix. The scar is 1,5 cm. in diameter and the internode which bears it is 17 cm. long.

The example illustrated on Pl. 111, fig. 2 has a scar 1,8 cm. in diameter and exhibits very distinctly the converging ribs which meet towards its centre. The umbilicus here is about 4 mm. wide, but if one compares such scars with those shown on the specimen given on Pl. 108, fig. 3, 4, it is clear that the opening seen in the centre of that of Pl. 111, fig. 2 gives a false impression of the true size of the pith opening which in this case is probably exaggerated by the apex of the pith cast of the branch scar being broken over. The same explanation applies to the opening seen in the centre of the fine branch scars exhibited on the specimens given at fig. 1, Pl. 81 and fig. 1, Pl. 112. The complete internode of the latter example is 21,5 cm. long.

Another small example is given at fig. 5, Pl. 108. This shows two branch scars on the node and is probably one of those examples on which three branch scars occur in a verticil.

The specimen of which a small fragment has been figured by ZEILLER (Valenciennes, Pl. 55, fig. 3) under the name of *C. ramosus*, is reproduced on our Pl. 110, fig. 1. The fossil belongs to *C. paleaceus* as shown by the ornamentation of its cortex, an identification with which ZEILLER completely agreed.

Some stem leaves are seen attached to the node of the specimen given on Pl. 112, fig. 2 of which the counterpart is seen on Pl. 110, fig. 2. The leaves are setaceous with expanded bases, about 2 cm. long and placed about 0,5 cm. apart.

The roots are shown on Pl. 111, where an example of a rhizome or basal portion of a stem is given at fig. 1. From the nodes, masses of roots are given off which

now appear as flattened ribbon-like bands bearing many small rootlets which spring from all over their surface and which are the *Myriophyllites gracilis* of ARTIS. (Ante-diluv. Phytology, Pl. 12). As well as exhibiting roots and rootlets, the specimen shows on the cortex very clearly the apiculate ornamentation so characteristic of this species.

Another specimen which is given on Pl. 113, fig. 2 shows a node bearing a small branch scar and also giving rise to a few roots of the *Myriophyllites* type. If the roots on this figure be examined with a lens, in addition to the few rootlets which still remain attached, the surface is seen to bear the small apiculate scars of many others which have been removed.

The only species with which *C. paleaceus* could be mistaken is *C. carinatus* STERNBERG (*C. ramosus* of ARTIS), but in reality the two species stand widely apart. In *C. carinatus* the foliage is of the *Annularia* type and the cone a *Calamostachys*, while in *C. paleaceus*, the foliage is of the *Asterophyllites* type and the cone of the type of *Volkmaninia pseudosessilis* GRAND' EURY (Loire, p. 43, Pl. 6, fig. 3). On the pith cast the branch scars are essentially different. Those of *C. paleaceus* have a very small pith cavity opening and the whole surface of the scar, with this exception, is covered by the converging extremities of the ribs, whereas in *C. carinatus* the pith cavity is very large leaving only a small margin on which the extremities of the ribs bend inwards. These differences in the form of the branch scar of the two species under discussion will be easily appreciated if the scars shown on the specimen of *C. paleaceus*, Pl. 108, fig. 3, be compared with the branch scar of *C. carinatus* on Pl. 106, fig. 3, or with those seen on the specimen of *C. carinatus* given on Pl. 108, fig. 1, 2.

DISTRIBUTION.

Great Britain.

Westphalian Series.

Horizon: Outcrop of Arley Mine.

Locality: Brickwork, Hibson Road at Marsden Height, Nelson, Lancashire. Collected by P. WHALLEY. (Pl. 113, fig. 2; Pl. 108, fig. 5; Pl. 116, fig. 2).

Horizon: Crow Coal.

Locality: Phoenix Brickworks, Crawcrook, Ryton, County of Durham. (Collected by W. ELTRINGHAM; Collection KIDSTON, 4662). (Another specimen on Pl. 113, fig. 1; Hancock Museum, Newcastle on Tyne).

Horizon: "Culm" Measures of Devon.

Locality: Cliff above Bideford Railway Station, Devonshire. Collection RODGERS, No. 12. (ARBER, Pl. 19, fig. 2).

Horizon: ?

Locality: No. 4 Pit, Claycross, Derbyshire. (Coll. Dr. J. MOYSEY).

Netherlands.

Westphalian Series.

Equivalent of the "Gaskohle and Fettkohle" of the Rheno Westfalian Coalfield.

Frequent in different borings in Southern Limburg and in the Peel Coalfield.

Equivalent of the Lower "Fettkohle" of the Rheno Westfalian Coalfield.

Horizon: Under Seam IV; Seam V, (Pl. 109, fig. 1, 2, 3; Pl. 110, fig. 2, 3; Pl. 111, fig. 1, 2; Pl. 112, fig. 1, 2, 3; Pl. 114, fig. 4; Pl. 155, fig. 3); Seam VI; Seam VIII.

Locality: Wilhelmina Colliery, near Heerlen, Limburg.

Horizon: Seam VIII.

Locality: Laura en Vereeniging Colliery, near Heerlen.

Horizon: Seam Senteweck.

Locality: Dominiale Mijn, Kerkrade, near Heerlen.

Germany.

Rheno Westfalian Coalfield.

Westphalian Series.

Middle "Fettkohle".

Horizon: ?

Locality: Auguste Viktoria Colliery. (Pl. 66, fig. 6).

Horizon: Seam N.

Locality: Lothringen Colliery. (Coll. Berggewerkschaftskasse, Bochum).

Horizon: Seam R.

Locality: Consolidation III Colliery. (Coll. Berggewerkschaftskasse, Bochum).

Horizon: Seam Nettelkönig.

Locality: Hagenbeck Colliery. (Pl. 81, fig. 1).

Lower "Fettkohle".

Horizon: Seam Dickebank.

Locality: Oberhausen Colliery. (Coll. Berggewerkschaftskasse, Bochum).

Horizon: Seam A.

Locality: Königsborn Colliery. (Coll. Berggewerkschaftskasse, Bochum).

Horizon: Seam Sonnenschein.

Locality: Von der Heydt Colliery. (Pl. 67, fig. 1).

Horizon: Seam R.

Locality: Kaiserstuhl (Westfalia) Colliery. (Geolog. Landesanstalt, Berlin; Berggewerkschaftskasse, Bochum).

"Fettkohle."

Horizon: ?

Locality: Glückauf-Tiefbau Colliery near Dortmund. (Geolog. Landesanstalt, Berlin).

"Fettkohle" or "Magerkohle."

Horizon: ?

Locality: Courl Colliery near Camen. (Geolog. Landesanstalt, Berlin; Selaginellites erdmanni VON ROEHL).

Horizon: ?

Locality: Boring Bramey Flierich IV. (Geolog. Landesanstalt, Berlin).

Aachen Coalfield.

Westphalian Series.

Horizon: Seam 20.

Locality: Eschweiler. (Coll. GRAEZER, École supér. des Mines, Paris).

Saar Coalfield.

Westphalian Series.

Horizon: ?

Locality: Duttweiler Colliery near Saarbrücken. (Museum für Naturkunde, Berlin; Pl. 111, fig. 3).

Lower Silesia.

Westphalian Series.

Horizon: ?

Locality: Waldenburg. (Pl. 110, fig. 4; Geolog. Institute, Breslau).

Horizon: Hangendschichten.

Locality: Melchior Colliery near Dittersbach. (Pl. 108, fig. 3; Geolog. Landesanstalt, Berlin).

Horizon: ?

Locality: Ruben Colliery near Neurode. (WEISS; Geolog. Landesanstalt, Berlin).

Upper Silesia.

Westphalian Series.

Horizon: Obere Muldengruppe.

Locality: Myslowitzer Wald. (Pl. 155, fig. 2; Geolog. Institute, Breslau).

Horizon: Muldegruppe.

Localities: Boring Borin II, Timmendorf, Sohrau near Kattowitz, at 671 m. (with Myriophyllites; Geolog. Landesanstalt, Berlin).

Jacobs Colliery. (Geolog. Landesanstalt, Berlin).

Saxony.

Upper Westphalian Series.

Horizon: ?

Locality: Lugau. (Museum, Chemnitz).

Austria.

Westphalian Series.

Schatzlarer Schichten.

Horizon: Seam 15.

Locality: Schatzlar. (Geolog. Landesanstalt, Berlin).

Horizon: ?

Locality: Ida Stolln near Schwadowitz. (Bergschule, Waldenburg).

France.

Bassin du Nord.

Westphalian Series.

Horizon: ?

Locality: Hardingen. (Pl. 110, fig. 1; École supér. des Mines, Paris).

Horizon: Seam Ste Marie.

Locality: Carvin, Pit No. 2. (Pl. 108, fig. 4; Musée houiller de Lille).

Horizon: Seam Henriette.

Locality: Anzin Collieries, Pit Renard. (École supér. des Mines, Paris).

Belgium.

Westphalian Series.

Hainaut, vide KIDSTON, 1911.

Horizon: ?

Locality: Levant du Flénu, Pit No. 19. (Pl. 115, fig. 1).

Horizon: Seam François.

Locality: Levant du Flénu. (Coll. RENIER).

Horizon: Seam Dix Paumes.

Locality: United Collieries of Charleroi, Pit des Hamandes. (Coll. RENIER).

Horizon: Seam Duchesse.

Locality: United Collieries of Charleroi, Pit No. 12. (Coll. RENIER).

Horizon: ?

Locality: Saint Eloi Colliery, Carnières.

Collieries of Mariemont. (Coll. DELTENRE).

Horizons: Seam Gigotte and Seam Du Parc.

Locality: Pit Placard.

Horizons : Seam Du Parc, Seam Aux Laies, Seam Dure.

Locality : Pit St. Arthur.

Horizons : Seam d'Or, Seam Du Parc.

Locality : Pit Réunion.

CALAMITES *cf.* PALEACEUS STUR.

Pl. 117, fig. 2.

DESCRIPTION.

Pith cast about 5 cm. wide. Internodes very long, attaining a length of 17 cm., ribbed. Furrows wide, bordered by two lines (?). Branch scar mamillaeform to whose centre (?) the ribs converge. Ribs longitudinally striated.

REMARKS.

The specimen is preserved as a pith cast and on the lower of the two nodes half of a branch scar is seen, the upper part being obscured by the cast of the pith cavity. The ribs converge over the surface of the branch scar in a similar manner to that seen in *C. paleaceus* though the scar is not sufficiently exposed to be certain that their structure is identical. Owing to the imperfect condition of the fossil we abstain from identifying it with *C. paleaceus* but it is the only species, known to us with which we can compare it.

DISTRIBUTION.

Netherlands.

Westphalian Series.

Horizon : Seam VIII.

Locality : Wilhelmina Colliery, near Heerlen, Limburg.

CALAMITES RENAULTI KIDSTON et JONGMANS.

Pl. 107, fig. 2, 3.

1888 *Calamites cisti* RENAULT, (*non* BGT.), (*pars*), Commentry, Atlas, Pl. 44, fig. 1; Text, Vol. II, 1890, p. 391.

1911 *Calamites cisti* JONGMANS, (*non* BGT.), (*pars*), Anleitung, I, p. 187, fig. 156.

DESCRIPTION.

Pith cast.

Internodes long, attaining a length of 12 cm., ribbed. Ribs fine, divided by a narrow furrow. Branch scars verticillate, approximate or slightly distant, subcircular with a central umbilicus. The ribs extend over the greater part of their surface. The scars are placed upon the nodal line and have a diameter of about 0.5 cm.

REMARKS.

This specimen of which the pith cast is 2,2 cm. wide at the top and about 3,5 cm. at the base, with a length of 33 cm. has been figured by RENAULT under the name of *C. cisti* to which species the plant cannot be referred as its ribbing differs and no such branch scars are known to occur on *C. cisti*.

Were it not for the fact that the specimen has already been figured and brought into the literature of the subject, it would have been better to have classed it with the unnamed specimens, however interesting it may be from some points of view, rather than to raise it to the rank of a species.

The name of *C. renaulti* which we apply to this specimen must therefore be regarded as a provisional one, till the true nature of the fossil is ascertained through the discovery of more complete specimens.

In RENAULT's figure the branch whorl is represented as occupying a very short internode but if one examines the enlargement of this part of his specimen given at our fig. 3, it will be seen that the branch scars are placed upon the node, which separates the two long internodes shown in our figure. The scars themselves are small, and as far as one can judge from the preservation of the specimen, have a very large pith opening in comparison to their size. The second node towards the base of the figure may also have borne branch scars but its preservation is too imperfect to permit one to determine whether the markings there seen are accidental or those of branch scars.

The enlargement further shows that the ribs are separated by narrow furrows. A small part of the base of the specimen is omitted from our figure.

DISTRIBUTIONS.

France.

Stephanian Series.

Horizon: 3 M. over the "Grande Couche."

Locality: Commentry, Trench of Saint Augustin. (Mus. Hist. nat., Paris).

CALAMITES BRITANNICUS WEISS sp.

Pl. 119, fig. 1; Pl. 122, fig. 2.

1888 *Eucalamites britannicus* WEISS, in KIDSTON, Ann. and Mag. Natur. Hist., (6), Vol. II, pag. 129, Pl. 7.

1911 *Calamites britannicus* JONGMANS, Anleitung, I, Mededeel. Rijks Opsporing van Delfstoffen, No. 3, p. 123, fig. 118.

DESCRIPTION.

Outer surface of stem faintly ribbed with here and there transverse wrinkles and fine longitudinal striations. Branch scars verticillate on every node, placed above the

nodal line, large, transversely elliptical with two concentric zones, distant. (Number in whorl unknown). Leaf scars catenulate, transversely elongated with a small central vascular cicatrice.

REMARKS.

The type specimen of this species is refigured on Pl. 119, fig. 1. The central node on the figure shows one perfect branch scar and a portion of another at the extreme margin. Midway between these two branch scars is a small scar about 2 mm. in diameter which may possibly belong to a root.

The branch scars are oval, about 1,2 cm. long and 0,6 cm. high. The umbilicus is central, oval, and about 0,5 cm. wide, though through displacement it appears eccentric in the lowest scar of the figure. The umbilicus is surrounded by a smooth band 3 mm. wide at its broadest part and this is separated by a shallow furrow from another narrow band about 1 mm. wide which in turn is limited by a narrow furrow which separates the scar from the cortex.

The cortex shows a number of elongate depressions, (in the cast), of irregular size and position in regard to each other but limited to the region of the stem immediately below the nodes. They may be of fungal origin.

Another small specimen is shown on Pl. 122, fig. 2. The bark here is finely striated longitudinally and in certain parts is transversely wrinkled. The two oval scars 1,2 cm. in diameter, show the central umbilicus about 4 mm. in diameter but the surrounding bands seen on the specimen already described are not exhibited on this example. Their absence may be explained through a difference of age or of preservation.

DISTRIBUTION.

Great Britain.

Westphalian Series.

Horizon: Above Thick Coal.

Locality: Shut End near Kingswinford, Staffordshire. (Pl. 119, fig. 1). Collected by C. BEALE.

Netherlands.

Westphalian Series.

Equivalent of the Upper „Fettkohle” of the Rheno Westfalian Coalfield.

Horizon: Shales at 534,5 M.

Locality: Boring S. M. VIII, Brunssum, near Heerlen, Limburg. (Pl. 122, fig. 2).

CALAMITES OCULATUS GEINITZ sp.

Text fig. 70.

1898 *Calamitina oculata* GEINITZ, Die Calam. der Steinkohlenformation, Mitteil. aus dem königl. mineral., geol. und prähist. Museum in Dresden, XIV, p. 12, Pl. 1, fig. 1, 1a.

1879 *Equisetites oculatus* GEINITZ, Sitzungsberichte der Isis in Dresden, p. 8, 9.

DESCRIPTION.

Stem large. Cortex smooth, finely striated longitudinally with many longitudinal cracks or clefts. Internodes varying in length. Branch scars borne on every internode, distant, subsemicircular, 4,5 cm. long and 2,8 cm. high, umbilicus oval, subcentral, 0,9 cm. in diameter and surrounded by a striated band 3 mm. wide, which is further surrounded by a smooth band 1 to 1,2 cm. wide. Leaf scars not known.

REMARKS.

GEINITZ unites with his *C. oculatus*, the *C. britannicus* WEISS but the two plants differ in the structure and form of the branch scars. The umbilicus of *C. oculatus* is surrounded by a band bearing radiating striae which in turn is surrounded by a much wider smooth band, whereas in *C. britannicus* the umbilicus is surrounded by a wide smooth band which in turn is succeeded by a narrow band. Further the form of the scars is not the same, those of *C. britannicus* being oval while those of *C. oculatus* are semicircular and are about three times as large as the branch scars of *C. britannicus*.



Fig. 70.

Calamites oculatus GEINITZ. Copied after GEINITZ.

DISTRIBUTION.

Germany.

Upper Westphalian Series.

Horizon: ?

Locality: Karl Pit of the "Lugau-Niederwurschnitzer Steinkohlenverein." (Zwinger Museum, Dresden).

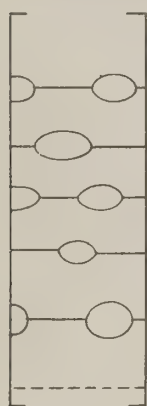
CALAMITES TRANSVERSALIS KIDSTON et JONGMANS nov. spec.

Pl. 59, fig. 2; Text fig. 71.

DESCRIPTION.

Internodes much shorter than broad, smooth, 1 to 2 cm. long and 3,5 cm. or more wide. Branch scars transversely oval with lateral sharp angles, 1,5 cm. broad and 0,6 cm. high, borne on every node, which is bent in a sinuous manner by the pressure of the scars. Umbilicus large, central with radiating striae. Outer surface smooth, with longitudinal cracks.

Leaf scars and pith cast unknown.



REMARKS.

This and the following species form a most curious group of Calamite stems, belonging to the *cruciatus*-section. They are remarkable for the shortness of the internodes and the large size of the branch scars.

The figure shows the only specimen of this species known to us, which is closely related to *C. bohemicus* but differs from it in the transversely oval form of the branch scars.

Fig. 71.

Calamites transversalis K. et J.

DISTRIBUTION.

Bohemia.

Westphalian Series.

Horizon: ?

Locality: Svina near Radnitz. (Pl. 59, fig. 2; Historisches Museum, Pilsen).

CALAMITES BOHEMICUS KIDSTON et JONGMANS nov. spec.

Pl. 59, fig. 3; Text fig. 72.

DESCRIPTION.

Internodes about 1,5 to 2,5 cm. long, width unknown but broader than long. Branch scars borne at every node, distant, large, vertically elongated, variable in size, attaining a diameter of 2,5 cm., with an oval slightly eccentric umbilicus, attaining a vertical diameter of 1,5 cm., and bearing numerous radiating striae. Nodal line very sinuous, displaced by the large branch scars.

Outer surface smooth with fine longitudinal striations.

Leaf scars and pith cast unknown.

REMARKS.

The branch scars vary much in size. The plant is most imperfectly known and until additional and more perfect examples have been discovered, a complete description of the species cannot be given.

This species of which we also know only a single specimen is closely related to *C. transversalis* but differs in its larger and longitudinally elongated branch scars with larger umbilicus.

DISTRIBUTION.

Bohemia.

Westphalian Series.

Horizon: ?

Locality: Kladno. (Pl. 59, fig. 3; Böhmisches Museum, Prag).

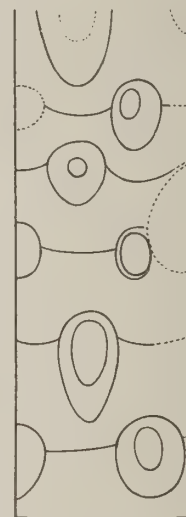


Fig. 72.

*Calamites
bohemicus*
K et J.

CALAMITES BRONGNIARTI STERNBERG.

Pl. 128, fig. 2; Pl. 129, fig. 1; Text fig. 73, 74.

1833 *Calamites brongniarti* STERNBERG, Versuch, II, Fasc. 5, 6, p. 48.

1828 *Calamites cruciatus* BGT., (non STERNB.), Histoire, I, Livr. 2, p. 128, Pl. 19.

1898 *Calamites (Eucalamites) cruciatus* SEWARD, (non STERNB.), Fossil Plants, pp. 376, 378, fig. 102.

1893 *Calamites cruciatus septenarius brongniarti* STERZEL, Rothlieg. im Plauenschen Grunde, Abhandl. K. Sächs. Ges. d. Wiss., XIX, p. 58.

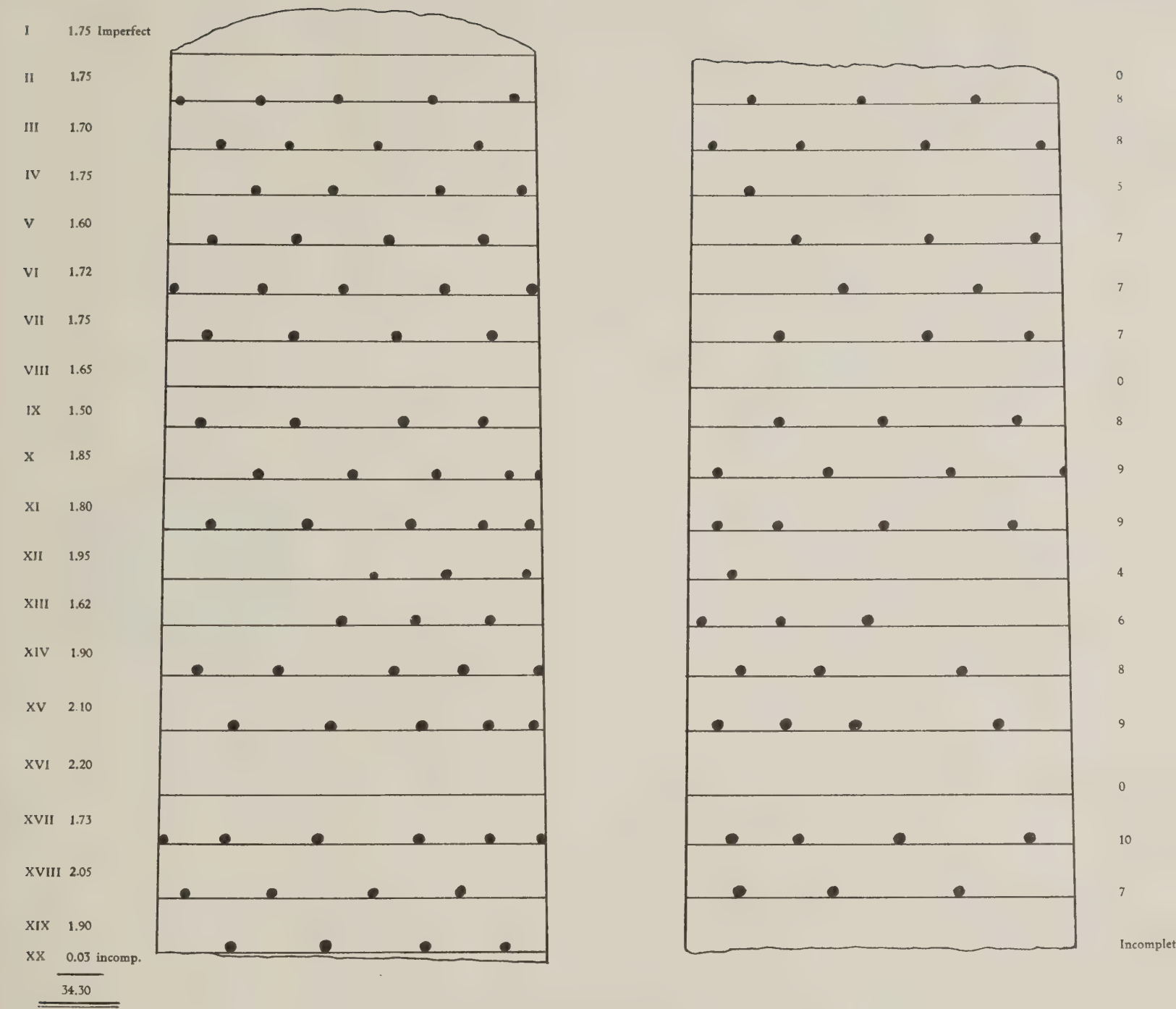
1911 *Calamites cruciatus septenarius brongniarti* JONGMANS, Anleitung, I, p. 140.

DESCRIPTION.

Stem attaining a width of 14 cm. or more. Internodes very short, 1,5 to 3 cm. long, not contracted at the nodes. Ribs wide, alternating and ending in a blunt point with a large oval tubercle on the upper end. Branch scars verticillate; branch bearing nodes occurring in periods of from 6 to 7, separated by a node without branch scars. Branch scars small, pit-like, four to five mm. in diameter, their number varying in the whorls from 4 to 10. No convergence of ribs towards the branch scars.

Length
of Internodes.

Number of Sc
on Internode



Text fig. 73.

CALAMITES BRONGNIARTI STERNB.

Diagram of specimen shown on Pl. 128, fig. 2; Pl. 129, fig. 1.
Half natural size.

REMARKS.

As far back as 1833 STERNBERG pointed out that the Calamite figured by BRONGNIART under the name of *C. cruciatus* did not belong to *Calamites cruciatus* STERNBERG and distinguished it as *C. brongniarti*.

The specimen we figure here on Pl. 128, fig. 2 and Pl. 129, fig. 1 is identical with BRONGNIART's figure.¹⁾ The figures show the two sides of a cast with a circumference of 29 cm. The internodes are of almost equal length, the difference between the longest and shortest being only 7 mm. The most interesting point in this specimen is the distribution of the branch scars. This is seen in the diagram, Text fig. 73, which shows the two sides of the pith cast. The uppermost node bears no branch scars, then follow six branch bearing nodes, with scars varying in number from 5 to 8, but on some of the nodes they are very irregularly placed and considerable intervals occur from which branch scars are absent. This period of branch-bearing nodes is succeeded by another node on which they are again absent. Then follows a branch-bearing period of 7 nodes which in turn is succeeded by a node bearing no branch scars. Part of a third branch bearing period is visible at the end of the specimen. The branch scars vary in number from 4 to 10 in a verticil and this specimen alone shows the worthlessness of all varieties or species whose chief distinctive character is the number of branches borne in the verticils.

The ribs have a straight course and when they meet the branch scars terminate against them without any deflexion whatever and this character alone, irrespective of the non-contracted nodes, at once separates *C. brongniarti* from the *C. cruciatus* of STERNBERG. The enlargement given by BRONGNIART on his Pl. 19 very clearly illustrates the specific characters of this plant. (Text fig. 74).

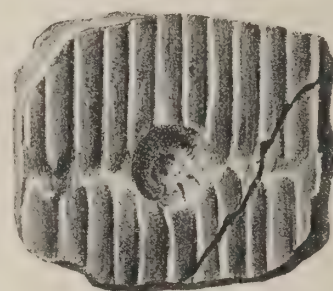


Fig. 74.

C. brongniarti STERNB.
Copied after BGT., Pl. 19.

DISTRIBUTION.

Great Britain.

Westphalian Series.

Horizon: Upper Chevet Rock.

Locality: Darfield, Yorkshire. Collected by the late Mr. STEPHEN SEAL. (Pl. 128, fig. 2; Pl. 129, fig. 1; Coll. KIDSTON, 4835).

France.

Stephanian Series.

Horizon: ?

Locality: Litry Collieries, Calvados. (BRONGNIART).

¹⁾ Our figure is shown on the plate in inverted position.

CALAMITES CRUCIATUS STERNBERG.

Pl. 113, fig. 3, 4; Pl. 114, fig. 3; Pl. 121, fig. 1; Pl. 130, fig. 1, 2?; Pl. 131, fig. 1;
Pl. 156, fig. 8.

- 1825 *Calamites cruciatus* STERNBERG, Versuch, I, Fasc. 4, p. 46, Tentamen, p. XXVII, Pl. 49, fig. 5; II, 1833, Fasc. 5, 6, p. 48.
- 1835 *Calamites cruciatus* GUTBIER, Zwickau, (pars), p. 19, Pl. 2, fig. 15, (non 9, 10, 12, 13, 16).
- 1845 *Calamites cruciatus* UNGER, (pars), Synopsis, p. 21.
- 1848 *Calamites cruciatus* GOEPPERT, (pars), in BRONN, Index palaeontol., p. 198.
- 1850 *Calamites cruciatus* UNGER, (pars), Gen. et spec., p. 46.
- 1881 *Calamites cruciatus* WEISS, Aus d. Steinkohlenf., p. 10, Pl. 7, fig. 42. (same figure Ed. II, 1882).
- 1887 *Calamites cruciatus* (et regularis) STUR, Calamar. schatzl. Schichten, Abh. K. K. Geol. Reichsanst., XI, 2, p. 85, (? Pl. 8, fig. 1; Text fig. 25).
- 1888 *Calamites cruciatus* TOULA, Die Steinkohlen, p. 203, (? Pl. 5, fig. 8, non Pl. 6, fig. 3).
- 1888 *Calamites cruciatus* ZEILLER, Valenciennes, p. 353, (non 1886, Atlas, Pl. 55, fig. 2).
- 1893 *Calamites cruciatus* STERZEL (pars), Rothl. im Plauenschen Grunde, Abh. K. Sächs. Ges. d. Wiss., XIX, pp. 57—87, (? Pl. 9, fig. 3); (non Pl. 9, fig. 4, Pl. 11, fig. 28—34).
- 1897 *Calamites cruciatus* CREDNER, Elemente der Geologie, 8. Aufl., p. 453, fig. 251.
- 1899 *Calamites cruciatus* HOFMANN et RYBA, (pars), Leitpflanzen, p. 25, Pl. 1, fig. 10, (non fig. 9).
- 1909 *Calamites cruciatus* GOTHAN, Die Entwicklung der Pflanzenwelt. Die Natur, VI, p. 42, fig. 27a.
- 1884 *Calamites cruciatus ternarius* WEISS, Steink. Calamar., II, Abh. z. Geol. Spezialk., V, 2, p. 112, Pl. 13, fig. 3.
- 1911 *Calamites cruciatus ternarius* JONGMANS, Anleitung, I, Mededeel. Rijks Opsporing van Delfstoffen, No. 3, p. 132.
- 1884 *Calamites cruciatus quaternarius* WEISS, Steink. Calamar., II, p. 113, Pl. 13, fig. 1.
- 1911 *Calamites cruciatus quaternarius* JONGMANS, Anleitung, I, p. 132, fig. 119.
- 1884 *Calamites cruciatus senarius* WEISS, Steink. Calamar., II, p. 114, Pl. 13, fig. 2.
- 1911 *Calamites cruciatus senarius* JONGMANS, (pars), Anleitung, I, p. 138.
- 1877 *Calamodendrofloyos cruciatus* GRAND' EURY, Loire, p. 293, (non fig. on Table A).
- 1869 *Calamites approximatus* SCHIMPER, (pars), Traité, I, p. 314, Pl. 19, fig. 1.
- 1876 *Calamitina* WEISS, Steink. Calamar., I, Abh. z. Geol. Spezialk., II, 1, p. 121, Text fig.
- 1899 *Calamites* (typ. *cruciatus*) POTONIE, Lehrbuch, p. 198, fig. 194.

DESCRIPTION.

Outer surface not known with certainty.

Pith cast.

Internodes much shorter than long, contracted at the nodal line. Ribs prominent, alternating, separated by somewhat wide, straight furrows and ending in blunt points, tubercles large, oval.

Branch scars placed on every node, verticillate, probably only three to six in a verticil, quincuncially arranged, mamillaeform, with a small central umbilicus. Ribs converging towards the branch scars.

REMARKS.

A specimen of *C. cruciatus* is given on Pl. 131, fig. 1, that illustrates the mamillate form of the branch scars which on the pith cast occur as depressions. Parts of four internodes are seen in the figure from all of which branches have arisen, but the majority of the scars are imperfectly preserved and only that on the second lowest node shows its true circular form and the ribs extending over its surface and meeting towards its centre. On the uppermost internode the somewhat wide furrows which divide the ribs are clearly exhibited.

The specimen figured by SCHIMPER as *Calamites approximatus* is reproduced on Pl. 121 at fig. 1. It shows part of a pith cast, 13 cm. wide with internodes varying from 2,5 to 3 cm. in length.

On the exposed surface of the cast each alternate node shows two branch scars and the other nodes one in the middle and one on each margin so probably the verticil consisted of four branches. The ribs are very prominent with a strong convergence to the branch scars. This specimen does not show so well the true form of the branch scar as that just described on account of its more imperfect preservation. The contraction of the pith cast at the nodes gives a slight convexity to the contour of the internodes.

A small but very characteristic specimen is shown on Pl. 156, fig. 8. The pith cast possesses three scars in each verticil, of the typical form and arrangement of *Calamites cruciatus*. It also shows the convergence of the ribs towards the umbilicus of the scar.

A small specimen showing very distinctly the typical form of the branch scar is given at fig. 3, Pl. 113. This small example shows four nodes. On the uppermost and third from the top two very typical *C. cruciatus* branch scars are exposed. Their cup-like form and small central umbilicus to which the ribs converge are beautifully shown in this figure. The specimen is compressed in such a way, that it appears to have only two branch scars on each node but a careful examination shows that there are really four and it was upon the assumption that each node only bore two scars that this specimen was originally referred to *C. ramosus* by KIDSTON. (Hainaut, p. 110, Jemappes, No. 2012).

Another pith cast is given on Pl. 113, fig. 4. Here also each of the nodes bears four scars. The best preserved scar is seen on the middle internode. This example shows very well the convergence of numerous ribs to the scars. Bands of about eight ribs, one on each of the internodes bordering the branch scar converge at their extremities towards it, forming an hour glass shaped body of which the umbilicus of the scar forms the neck. The arrangement of the ribs in this manner is a most important specific character of *C. cruciatus* and one by which alone the species can be separated from *C. brongniarti* STERNBERG, where the ribs do not converge towards the scars. The uppermost node of this example shows the blunt points of the ribs and their terminal tubercles.

An example with verticils of six scars, the original of *C. cruciatus senarius* of WEISS, is reproduced on our Pl. 130, fig. 1. The specimen is imperfectly preserved but shows with tolerable distinctness the circular pit-like branch scars and the convergence of the ribs towards them.

A somewhat curiously preserved specimen which probably may belong to *C. cruciatus*, is shown on Pl. 130, fig. 2. The pith cast is covered by a thin layer of coaly matter, possibly representing the remains of the wood. At a few places on the upper internode this has been removed and small portions of the pith cast revealed. The middle node bears four scars and that lying to the left shows part of its impression on the pith cast revealed through the removal of its covering. The cavities of the two branch scars placed on the central part of the verticil are still filled with matrix.

What is probably the true outer surface of the cortex of *C. cruciatus* is seen on Pl. 114, fig. 3. This specimen has been figured by WEISS under the name of *Calamitina* but our explanation of the fossil differs from that given by WEISS, who describes the large scars as scars of some appendicular organ and the smaller scars as the branch scars. Some other small scars he describes as leaf scars. These however we cannot discover on the specimen. According to our view the large scars are those of the branches while the smaller scars we believe to be the leaf scars. These latter attain a size of 7 mm. though some of them are slightly smaller. They are subcircular, though some are much deformed and assume varying shapes, but all have a small central cicatrice and are about 2 mm. distant from each other. They form a band upon the node and bend downwards below the branch scars, assuming their ordinary position immediately they have passed them. The branch scars are circular, mamillate and agree with those of *C. cruciatus*, to which we provisionally refer this specimen. The cortex is smooth and shows a number of longitudinal cracks or ridges.

Calamites cruciatus differs from *C. brongniarti* in the convergence of the ribs towards the branch scars and by the constriction of its nodes and from *C. multiramis* in its circular mamillate branch scars and in the entire absence of the ribbed band at the nodes and the surface ornamentation of the ribs. This last character alone separates from *C. cruciatus* even those specimens of *C. multiramis* on which the ribs are visible over the whole length of the internodes.

It differs from rhizomatic portions of *C. undulatus* by the regular quincuncial position of the branch scars and by the absence of surface ornamentation of its ribs.

C. cruciatus differs from *C. carinatus* and *C. paleaceus* by its shorter internodes and by the distribution and the number of the branch scars. From *C. carinatus*, *C. cruciatus* also differs in the structure of the scars. A good character by which pith casts of *C. cruciatus* can be distinguished from those of *C. paleaceus* and *C. carinatus* is the entire absence of the double lined furrows on the pith casts of *C. cruciatus*.

DISTRIBUTION.

Russia.

Westphalian Series.

Horizon: ?

Locality: Donetz Coalfield. (C. cruciatus ternarius WEISS).

Germany.

Saar Coalfield.

Westphalian Series.

Horizon : ?

Locality : Saarbrücken. (Original STERNBERG). (C. approximatus SCHIMPER, Traité, I, Pl. 19, fig. 1; our Pl. 121, fig. 1).

Horizon : Liegende Flammkohlenpartie, 40 M. Seam.

Locality : Reden Colliery, Ostfeld. (Mus. Chemnitz, Pl. 113, fig. 4).

Horizon : ?

Localities : Koenig Colliery. (Calamitina WEISS, Text fig.; our Pl. 114, fig. 3).

Heinitz Colliery near Saarbrücken. (C. cruciatus senarius WEISS, Pl. 13, fig. 2; our Pl. 130, fig. 1).

Friedrichsthal Colliery. (Geolog. Landesanstalt, Berlin).

Saxony.

Westphalian Series.

Horizon : ?

Locality : Zwickau. (GUTBIER).

Austria.

Westphalian Series.

Schatzlarer Schichten.

Horizon : ?

Locality : Mährisch Ostrau, Miroschau. (HOFMANN and RYBA).

Horizon : Seam "15 Zoll. Flötz".

Locality : Schatzlar. (C. cruciatus quaternarius WEISS).

Netherlands.

Westphalian Series.

Equivalent of the Gaskohle of the Rheno Westfalian Coalfield.

Horizon : Shales at 937 M.

Locality : Boring 18, Maris, Peel Coalfield. (Pl. 156, fig. 8).

Belgium.

Westphalian Series.

Horizon : ?

Localities : Jemappes. (Mus. Hist. Nat. Bruxelles; Pl. 113, fig. 3).

Mons. (Geol. Museum, München; Pl. 131, fig. 1).

France.

Stephanian Series.

Horizon: Seam No. 6.

Locality: Collieries of Ahun (Creux), Pit Robert. (École supér. des Mines, Paris, Pl. 130, fig. 2).

Westphalian Series.

Horizon: Seam Augustin.

Locality: Liévin, Pit No. 3. (Musée houiller de Lille).

CALAMITES MULTIRAMIS WEISS *emend.*

Pl. 114, fig. 1, 2; Pl. 115, fig. 2; Pl. 116, fig. 1; Pl. 117, fig. 1; Pl. 118, fig. 2; Pl. 119, fig. 2;
Pl. 120, fig. 1, 2; Pl. 122, fig. 3, 4; Pl. 123, fig. 1–5; Pl. 124, fig. 2, 3; Pl. 125, fig. 1, 2;
Pl. 126, fig. 1, 2; Pl. 127; Pl. 128, fig. 1; Text fig. 75, 76, 77.

1884 *Calamites multiramis* WEISS, Steinkohlen Calam., II, Abh. z. Geol. Spezialk., V, 2, p. 114, Pl. 10, fig. 2; Pl. 12.

1893 *Calamites cruciatus multiramis* WEISS, var. *typicus* STERZEL, Rothlieg. im Plauenschen Grunde, Abh. K. Sächs. Ges. d. Wiss., XIX, p. 58.

1911 *Calamites cruciatus multiramis* var. *typicus* JONGMANS, Anleitung, I, p. 141, fig. 123, 124.

1893 *Calamites cruciatus multiramis* var. *vittatus* STERZEL, Rothlieg. im Plauenschen Grunde, pp. 58, 76, Pl. 9, fig. 1.

1911 *Calamites cruciatus multiramis* var. *vittatus* JONGMANS, Anleitung, I, p. 143.

1835 *Calamites cruciatus* GUTBIER, (*pars*), Zwickau, p. 19, ? Pl. 2, fig. 9, 10, 12, 13, 16, (*non* fig. 15).

1837 *Calamites approximatus* L. et H., Fossil Flora, III, p. 171, Pl. 216. (Figure inaccurate).

1887 *Eucalamites (Calamites) cruciatus senarius* KIDSTON, Radstock, Trans. Roy. Soc. Edinburgh, XXXIII, pp. 340, 341, fig. 1.

1890 *Eucalamites cruciatus senarius* KIDSTON, Proc. Roy. Phys. Soc. Edinburgh, X, p. 381.

1893 *Calamites cruciatus quinquenarius britannicus* STERZEL, Rothlieg. im Plauenschen Grunde, p. 58.

1911 *Calamites cruciatus senarius* JONGMANS, (*pars*), Anleitung, I, p. 138.

1855 *Calamites approximatus* GEINITZ, (*pars*), Sachsen, Pl. 12, fig. 2.

1877 *Calamodendron punctatum* RENAULT, Congrès scientifique de France, p. 311.

1888 *Calamodendron punctatum* RENAULT, Commentry, Atlas, Pl. 56, fig. 4, 5; Text, II, 1890, p. 465.

1893 *Calamites cruciatus septenarius* STERZEL var. *punctatus* STERZEL, Rothlieg. im Plauenschen Grunde, p. 58.

1911 *Calamites cruciatus punctatus* JONGMANS, Anleitung, I, p. 143.

1877 *Calamodendroxylon congenium* GRAND' EURY, Loire, p. 291.

1890 *Calamodendron congenium* RENAULT, Commentry, p. 461.

1893 *Calamodendron congenium* RENAULT, Flore d'Autun et d'Épinac, p. 124, (Pl. 59, fig. 1 Anatomy only).

1888 *Calamodendrophloios congenium* RENAULT, Commentry, Pl. 56, fig. 3; Text, II, 1890, p. 464.

- 1911 *Calamites cruciatus quaternarius forma congenius* JONGMANS, Anleitung, I, p. 135, fig. 121.
- 1878 *Calamodendron cruciatum* ZEILLER, (non STERNB.), Explic. Carte géol. de la France, Atlas, Pl. 174, fig. 3; Text, IV, 2, 1879, p. 152; Végét. foss., 1881, p. 152.
- 1884 *Calamites elongatus* WEISS, (non GUTBIER), Steink. Calamarien, II, p. 117.
- 1893 *Calamites cruciatus elongatus* STERZEL, Rothlieg. im Plauenschen Grunde, p. 60.
- 1911 *Calamites cruciatus elongatus* JONGMANS, Anleitung, I, p. 154.
- 1884 *Calamites decurtatus* WEISS, Steink. Calam., II, p. 118.
- 1911 *Calamites decurtatus* JONGMANS, Anleitung, I, p. 143.
- 1885 *Calamites cruciatus* SAPORTA et MARION, (non STERNB.), Évolution, Phanérog., I, p. 35, fig. 13.
- 1887 *Calamites rittleri* STUR, Calam. schatzl. Schichten, Abh. K. K. Geol. Reichsanst., XI, 2, p. 86.
- 1912 *Calamites rittleri* GRAND'EURY, Recherches géobotaniques sur les forêts et les sols fossiles, I, p. 23, (non Pl. 3, fig. 3y).
- 1887 *Calamites gutbieri* STUR, (pars), Calam. schatzl. Schichten, p. 86.
- 1893 *Calamites cruciatus gutbieri* STERZEL, (pars), Rothlieg. im Plauenschen Grunde, p. 59.
- 1911 *Calamites cruciatus gutbieri* JONGMANS, (pars), Anleitung I, p. 152, fig. 132.
- 1888 *Calamodendron striatum* RENAULT, Commentry, Atlas, Pl. 54, fig. 5; Text, II, p. 457.
- 1911 *Calamites cruciatus striatus* JONGMANS, Anleitung, I, p. 150.
- 1890 *Calamodendron cruciatum* var. *oculatum* GRAND'EURY, Gard, p. 218.
- 1890 *Calamodendron cruciatum* var. *encarpatum* GRAND'EURY, Gard, p. 218.
- 1893 *Calamites cruciatus septenarius fasciatus* STERZEL, Rothlieg. im Plauenschen Grunde, pp. 58, 75, Pl. 8, fig. 4, 5.
- 1911 *Calamites cruciatus septenarius fasciatus* JONGMANS, Anleitung, I, p. 139.
- 1855 *Calamites approximatus* GEINITZ, (non SCHLOTH.), (pars), Sachsen, p. 7, Pl. 11, fig. 2, (Figure very inaccurate); Pl. 12, fig. 1.
- 1893 *Calamites cruciatus quinquenarius doehleensis* STERZEL, Rothlieg. im Plauenschen Grunde, pp. 57, 78, Pl. 9, fig. 2, (non fig. 3).
- 1911 *Calamites cruciatus quinquenarius* JONGMANS, Anleitung, I, p. 137.
- 1893 *Calamites cruciatus infractus* STERZEL, (pars), Rothlieg. im Plauenschen Grunde, p. 79, ? Pl. 8, fig. 6.
- 1893 *Calamites cruciatus manebachensis* STERZEL, Rothlieg. im Plauenschen Grunde, p. 59.
- 1911 *Calamites cruciatus manebachensis* JONGMANS, Anleitung, I, p. 151, fig. 131.
- 1893 *Calamites cruciatus foersteri* STERZEL, Rothlieg. im Plauenschen Grunde, pp. 59, 68, Pl. 7, fig. 5, 6, (non Pl. 8, fig. 1-3).
- 1911 *Calamites cruciatus foersteri* JONGMANS, Anleitung, I, p. 149.

DESCRIPTION.

Outer surface.

Smooth. Internodes varying in length from 1,5 to 21,5 cm. or more. The shorter internodes occur singly or in groups of 2 to 16 or more, separated by one or rarely more very long internodes. Branch scars verticillate, distant, quincuncially arranged, oval, with eccentric umbilicus from which radiate numerous very narrow ribs. Leaf scars about 2 mm. in diameter, semilunate or subcircular with a central cicatrice and distant from each other by about their own width.

Pith cast.

Typical form. Nodes very short. Ribs in central portion absent or only feebly represented, at the nodes very prominent and placed upon a raised band and strongly converging towards each other in little groups of two or three. Surface of pith cast between these raised up bands beautifully ornamented with a very fine granulation, the individual elements of which are more or less distinctly arranged in vertical lines.

Branch scars borne on every node, quincuncially arranged, placed within an oval area bounded on each side by the band bearing the converging ribs. Umbilicus small, central, circular.

Less typical specimens have generally longer internodes than the shortest seen on the typical examples with a more or less distinct ribbing upon the whole length of the internodes though more marked towards the nodes. Branch scars circular and not placed within an eye-shaped area as seen on the more typical forms. Ornamentation of the surface of the cast not so frequently observable but on well preserved specimens the same as that occurring on typical examples of the species.

REMARKS.

Of *Calamites multiramis* a number of specimens are figured with the object of showing the variation in this species, for if the extreme forms were alone figured and described one might easily consider them as specifically distinct. The various forms however are so connected by intermediate links that the whole appears to form a continuous chain which it is impossible to break at any point.

The original type of *C. multiramis* of WEISS is shown on Pl. 115, fig. 2. The specimen is a pith cast. The raised up band running along the node on which the converging ribs form fan-like little groups is especially well seen on the upper part of the figure. This band is not so well seen on the lower margin of the nodes, although it is present. On the middle area of the internode particularly at the upper end of the fossil, the ribs are at some places quite absent, at other places they are feebly represented. At the lower margins of the internodes, the prominent ribbed bands which usually accompany the nodes are little distinguishable and the ribs extend across the whole internode. The branch scars are distant, but not well defined on this example.

A specimen which shows better in some respect, the peculiar characteristics of the band bordering each side of the nodal line is given on Pl. 117, fig. 1. Here the central portions of the internodes are entirely devoid of ribbing and the two bands with their converging ribs stand out in great prominence. Adhering to certain portions of the surface of the cast is a coaly layer which shows fine longitudinal lines divided by wider spaces. These lines do not alternate at the nodes and cannot be ascribed in any way to the ribbing of the pith cast but probably represent the wedges of wood separated by their accompanying medullary rays with which the pith cast was originally surrounded. The branch scars are not well seen on this specimen.

The impression from which the cast just described was taken is shown on Pl. 116, fig. 1. Here we appear to be looking at the inner surface of the cortex with the ribbing of the wood zone impressed upon it. At the nodes, in addition to the branch scars, a number of shadow-like depressions are seen, separated from each other by about their own width. These probably indicate the position of the strands which passed out to the leaves and may correspond to the centre of the little groups of confluent ribs at the nodes of the pith cast. On the upper margin of the figure the impression of the outer surface of the cortex is seen. The nodes in this impression are in continuity with those seen on the other parts of the specimen. The internodes are irregularly striated and these striae may be the impression of the wood wedges shadowed through the cortex and therefore a structure only accidentally imparted to the impression of the cortex.

A very instructive specimen is shown on Pl. 122, fig. 3. This exhibits a pith cast, almost entirely covered with a thin layer of coal. A ribbing is seen on the coaly layer across the whole length of the internode and this ribbing does not terminate in prominent bands along the nodes. There is here in fact most probably the remains of the wood zone, and this ribbing both in its regularity and in the absence of prominence at the nodes most probably represents the wedges of the wood zone. After the photograph of this specimen for figure 3 was made, part of the coaly matter was removed when a typical pith cast of *Calamites multiramis* was exposed. Fig. 1, 2 of Pl. 123 show two portions of internodes of this pith cast, where the prominent raised up border running along the nodes with the smooth area on the middle of the internodes and the typical eye-like branch scar area with its central umbilicus, are all distinctly seen. These two figures further show with remarkable clearness the fine granular ornamentation of the outer surface of the pith cast and they should be examined with a lens to see its great beauty and the perfection of its preservation. On the coaly surface the branch scars are oval and pointed at the two sides with a central umbilicus.

Another interesting specimen, the type of *Calamodendron punctatum* of RENAULT, but which must be referred to *C. multiramis*, is given on Pl. 127. The specimen shows a portion of the cast, adhering to what may be possibly the remains of the wood zone and on the upper node on the left hand corner immediately above the remains of the pith cast, the little cicatrices of the vascular bundles passing out to the leaves are most distinctly seen. The branch scars here, as seen on the wood envelope are circular and have quite a different form from those seen on the pith cast.

Another specimen shown on Pl. 123, fig. 5 is part of the cast that has been removed from the impression seen on Pl. 124, fig. 2. Fig. 2, Pl. 124 possibly shows the inner surface of the wood but it is very difficult to distinguish between the inner surface of the wood and the inner surface of the cortex with the wood impressed upon it.

The cast of *C. multiramis* given on Pl. 114, fig. 1 is not only historically interesting in bearing in BRONGNIART's writing the name of *Calamodendron cruciatum*, but in showing in an excellent manner the band which borders the nodes on both sides. The branch

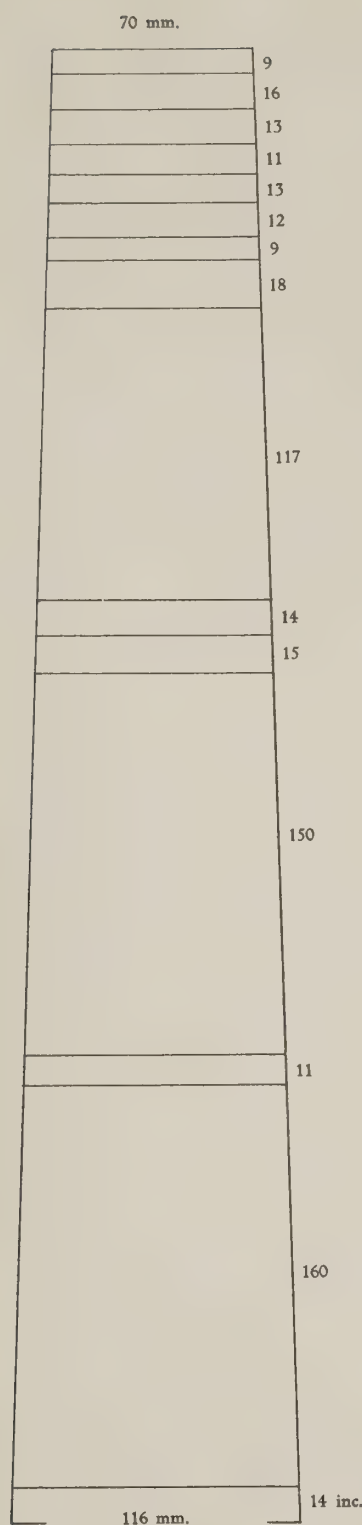


Fig. 75.

Calamites multiramis WEISS.

Diagram of the complete original specimen of *Calamodendron striatum* RENAULT, Commentry, Pl. 54, fig. 5.

$\frac{1}{3}$ nat. size.

Mus. hist. nat. Paris, 10718.

scars show the small round central umbilicus but the eye-shaped surrounding area is not very clearly defined.

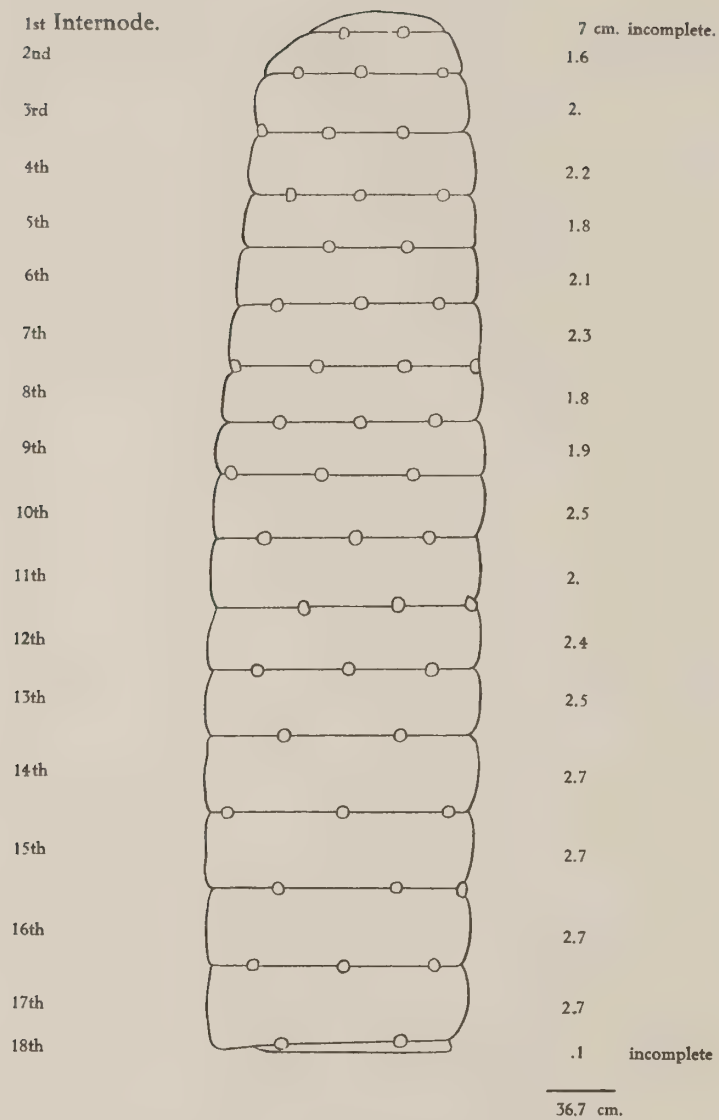
A specimen originally labelled *Calamites rittleri* by STUR is given on Pls. 119, fig. 2 and 120, fig. 1. Figure 2, Pl. 119 fits on to Pl. 120, fig. 1 and the details of the crack, passing down the centre of the specimen, show how the two figures must be placed, as a portion of the specimen is repeated in both. The chief interest of the figure is the occurrence of the long internode, about 21,5 cm. in length which lies below a group of short internodes¹⁾ and which is followed by another long internode, an unusual condition in such cases.

The specimen given on Pl. 120, fig. 2 is a reproduction of the fossil figured by GEINITZ under the name of *C. approximatus* (Pl. 12, fig. 1) and though one would scarcely think it from an examination of his figure, the specimen is nevertheless a typical example of *C. multiramis*.

With the purpose of showing the relationship of the shorter and the longer internode areas to each other, a text figure is given at fig. 75 of the complete fossil of which a part has been published by RENAULT under the name of *Calamodendron striatum*. A study of RENAULT's figure will at once show that this plant must be referred to *C. multiramis*.

Another specimen which is also typical of *C. multiramis* is given on Pl. 128, fig. 1. This is the original of LINDLEY and HUTTON's *C. approximatus*, of which a diagrammatic text figure has been given by KIDSTON under the name of *C. cruciatus senarius*. The diagram is reproduced at our text fig. 76. The greater portion of the cast is covered with a coaly layer probably representing the wood zone which however has fallen from the specimen at many places. On the third node from the top towards the centre where the coaly layer has been removed, a strongly marked band is seen extending on each side of the nodal line, with a smoother area towards the centre of the internode. On the same nodal line, as well as on the 5th and 7th nodal lines from the bottom, little dot-like passages, through which the vascular bundles have passed to the leaves, are distinctly seen.

¹⁾ It was necessary for reasons of space to place the figures in inverted position on the plates.



Text fig. 76.

CALAMITES MULTIRAMIS WEISS.

Original of *C. approximatus* L. et H.

$\frac{2}{5}$ nat. size.

The specimen given on Pl. 114, fig. 2, which is the original of *C. approximatus* of GEINITZ (Pl. 11, fig. 2) and of *C. cruciatus septenarius fasciatus* of STERZEL, must also be referred to *C. multiramis*. It shows though faintly a greater prominence of the ribs towards the node especially at the third node from the base and also the eye-shaped branch scars. It corresponds to the specimens seen on Pl. 125, fig. 2 and Pl. 126, fig. 2 but has shorter internodes.

On Pl. 123, fig. 3 and 4 are figured two sides of a pith cast. These, as seen at fig. 3, have longer internodes in proportion to their breadth, than usually seen in typical *C. multiramis* except in those cases where much elongated internodes are interpolated. The band bordering the nodes is also not so clearly separated from the general ribbing of the internode, but in some of the smoother parts of the internode the characteristic surface marking of this species can be clearly seen if the figure be examined with a lens. On the other side of the specimen, given at fig. 4, the ribbing on the whole internode, especially in the upper part of the figure, is equally strong and all differentiation of the extremities of the ribs bordering the nodes has entirely disappeared, except on the third internode from the base of the fossil where also the fine surface ornamentation can be observed.

On Pl. 125 at fig. 2 is given another specimen somewhat similar to that last described. The ribs extend over the whole length of the internodes, only at a few places becoming obscure. When however they meet with the nodal line they converge as in all the other specimens of the species to form little groups of two or three. At fig. 1 of the same plate another example is given which shows the same characters mentioned in the description of the last specimen. Here the branch scars are more distinctly seen and as the internodes become longer and ribbed throughout their whole length the branch scars seem to assume a more circular form and lose the clearly defined eye-like area in which they are placed.

An enlargement of portion of the specimen seen on Pl. 125, fig. 1 is given on Pl. 124, fig. 3. This shows the ribbing and one of the scars placed in a slightly eye-shaped area as well as the surface ornamentation which is absolutely identical with that seen on Pl. 123, fig. 1, 2.

Two specimens with somewhat longer internodes but agreeing in all respects with those just described are given on Pl. 118, fig. 2 and Pl. 126, fig. 2.

The original of *C. elongatus* WEISS (*non* GUTBIER) is seen on Pl. 126, fig. 1. The arrangement of the ribs on the node at the upper end of the specimen clearly shows that this fossil can only be regarded as a fragment of *C. multiramis* with long internodes.

The only specimen known to us which shows the impression of the outer surface of the stem is given on Pl. 122, fig. 4. It possesses portions of 6 internodes and is partially covered with a layer of coal which may represent the bark with the impression of the wood wedges marked upon its inner surface as already described in other specimens. From a portion of the specimen this coaly layer has been removed when a very fine impression of the outer surface of the bark is seen on the matrix, as well as

some of the branch scars and indications of the leaf scars. This specimen is not only valuable on account of having supplied us with the only knowledge we possess of the outer surface of the bark and the external appearance of the branch scars, but also in enabling us to compare the round structureless scars on this example which represent the filled in passages through which the vascular bundles passed to the attached organs, with the appearance of the scars left on the outer surface of the stem.

These scars as seen on the outer surface are oval, with numerous fine striae extending from the margin towards the centre. The umbilicus is eccentric and the scars measure over 1,5 cm. in greatest diameter. The round scars seen on the inner portion of the stem are only about 0,9 cm. in diameter and show no definite structure.

The branch scars are quincuncially placed and stand about 3,5 cm. apart. The leaf scars are distant, about 3 mm. in diameter, of irregular shape, though probably through imperfect preservation. They form a distinct band which is deflected downwards by the branch scars when it takes a sinuous course while passing round their basal portion.

At Text fig. 77 is given a reproduction of RENAULT's figure of *Calamodendron congenium* from which it will be seen that it differs in no single point from the typical pith casts of *C. multiramis* to which STUR applied the manuscript name of *C. rittleri*.

C. decurtatus WEISS, of which the original is preserved in the Museum of the Landesanstalt, Berlin, is also the *rittleri*-form of *C. multiramis*.

Typical specimens of the *C. multiramis* (*C. rittleri* STUR, mnsr) can be separated at first sight from all other species of *Calamites* known to us by the curious band which extends along the nodal line. From *C. cruciatus* and *C. brongniarti* it is further distinguished by the eye-shaped branch scar of the pith cast.

DISTRIBUTION.

Great Britain.

Radstockian Series.

Horizon: Radstock Group.

Locality: Camerton, Somersetshire. (Pl. 128, fig. 1; *C. approximatus* L. et H., Pl. 216).

Austria.

Permian.

Locality: Rossitz in Moravia, Seam III. (*C. rittleri* STUR, mnsr., Pl. 116, fig. 1; Pl. 117, fig. 1).



Fig. 77.

Calamites multiramis
WEISS.

(*Calamodendron*
congenium RENAULT).
Reduced copy.

Bohemia.

Permian (? or *Stephanian*).

Locality: Frisch Glück Pit, Pilsen. (Pl. 123, fig. 3, 4).

Hungary.

Stephanian Series.

Locality: Szekul, Banat. (K. K. Hofmuseum, Wien).

Germany.

Ottweiler Schichten.

Localities: Wettin. (Museum, Göttingen).

Löbejun. (Museum, Halle).

Thuringia.

Permian.

Localities: Ilmenau. (*C. multiramis* WEISS, *C. decurtatus* WEISS; Geol. Landesanstalt, Berlin; Pl. 115, fig. 2).

Manebach near Ilmenau, Manebacher Schichten. (GEINITZ, *C. approximatus*, Pl. 12, fig. 1; our Pl. 120, fig. 2; Zwinger Museum, Dresden), (Museum, Halle; Museum für Naturkunde, Berlin).

Ilfeld a. Harz, Ottostollen. (Geolog. Landesanst., Berlin).

Saxony.

Permian.

Localities: Zaukerode im Plauenschen Grund. (Zwinger Museum, Dresden; GEINITZ, *C. approximatus*, Pl. 9, fig. 2, Pl. 11, fig. 2; our Pl. 114, fig. 2).

Oberes Porphyrtuff, Chemnitz-Hilbersdorf. (Museum, Chemnitz).

Augustusschacht am Windberg. (Museum, Dresden).

Plauenscher Grund. (*C. cruciatus infractus* STERZEL's Pl. 8, fig. 6).

Döhlen im Plauenschen Grund. (*C. multiramis* WEISS).

Upper Westphalian Series.

Horizon: ?

Localities: Ida and Helenen Pit, Hohndorf. (Museum, Chemnitz).

Segen Gottes Pit, Lugau. (Pl. 119, fig. 2; Pl. 120, fig. 1; K. K. Hofmuseum, Wien).

Oberhohndorf. (Geinitz, Pl. 12, fig. 2; Zwinger Museum, Dresden).

Kaiserin Augusta Pit, Oelsnitz. (Pl. 126, fig. 2; Museum, Chemnitz).

Zwickau. (Pl. 125, fig. 2; Geolog. Landesanst., Berlin).

Horizon: Russkohlen Seam.

Locality: Morgenstern Pit, Reinsdorf near Zwickau.

Horizon: Seam II, "Vertrauenflötz".

Locality: Lugau, Segen Gottes Pit. (Pl. 123, fig. 5; Pl. 124, fig. 2; Museum, Chemnitz).

Horizon: Seam II, "Hauptflötz".

Locality: Lugau, Neu Schacht. (Pl. 124, fig. 3; Pl. 125, fig. 1; Geolog. Landesanst., Leipzig).

Horizon: Over Seam Glückauf.

Locality: Oelsnitz, Gotteshilfe Pit. (Pl. 118, fig. 2; Museum, Chemnitz).

Saarbrücken Coalfield.

Stephanian Series.

Ottweiler Schichten.

Horizon: ?

Locality: Griesborn near Saarbrücken. (WEISS).

Upper Westphalian Series. (Saarbrücker Schichten).

Horizon: ?

Localities: Gerhard Colliery near Saarbrücken. (*C. elongatus* WEISS; Pl. 126, fig. 1).

Hangendes Grube Kronprinz near Hirtel. (Museum für Naturkunde, Berlin).

France.

Stephanian Series.

Localities: Collieries of la Machine, Decize, Dép. de la Nièvre. (*Calamodendron cruciatum* ZEILLER, École supér. des Mines).

Fossil Forest of Saint Eloy and of la Bouble. (*C. rittleri* GRAND' EURY).

Collieries of Carmaux, Dép. de Tarn. (École supér. des Mines, Paris).

Collieries of Ahun, Couche 3. (École supér. des Mines, Paris).

Aubin. (Coll. BRONGNIART, Mus. d'Hist. nat., Paris; Pl. 114, fig. 1).

Gard Coalfield.

Localities: Saint Étienne. (École supér. des Mines, Paris; Pl. 122, fig. 4; Coll. GRAND' EURY).

Collieries of la Grand' Combe, Pit du Ravin. (Mus. d'Hist. nat., Paris; Pl. 122, fig. 3; Pl. 123, fig. 1, 2).

Commentry Coalfield.

Localities: "Banc des roseaux". (RENAULT, *Calamodendron striatum*).

St. Pierre, La Cour, Mayenne. (École supér. des Mines, Paris).

Trench of l'Ouest, in the shales intercalated in the second Seam. (*Calamodendron punctatum* and *C. congenium* RENAULT), (Pl. 127, fig. 1).

Trench of l'Espérance in the "Banc des roseaux". (*C. congenium* GRAND' EURY).

CALAMITES MULTIRAMIS WEISS.
VAR. ELONGATUS GUTBIER pro. spec.
Pl. 124, fig. 1; Pl. 130, fig. 3; Pl. 133, fig. 2, 3.

- 1835 *Calamites elongatus* GUTBIER, Zwickau, p. 28, Pl. 3b, fig. 2, 3.
1893 *Calamites cruciatus gutbieri* STERZEL, (*pars*), Rothl. im Plauenschen Grunde, Abh. K. Sächs. Ges. d. Wiss., XIX, p. 59.
1911 *Calamites cruciatus gutbieri* JONGMANS, (*pars*), Anleitung, I, p. 152, (*non* fig. 132).
1888 *Arthropitys communis* RENAULT, Commentry, Atlas, Pl. 53, fig. 2; Text, II, 1890, p. 442.

DESCRIPTION.

Pith cast.

Internodes usually longer than broad varying in length from 4,5 to 12,5 cm. or more, slightly constricted at the nodes. Ribs straight, extending over the whole internode but prominently running together in little groups of three or four at the nodal line. Irregularly placed small circular branch scars occur on some of the nodes.

REMARKS.

This variety is founded on imperfect specimens and had it not been that they have been figured by GUTBIER and RENAULT and thus have entered into the literature of the *Calamariæ* there would not have been much necessity to refer to them.

The specimen shown on Pl. 130, fig. 3 is a reproduction of the fossil figured by RENAULT under the name of *Arthropitys communis* but does not however differ in any essential manner from GUTBIER's specimen of *C. elongatus*.

The chief point of difference between *var. elongatus* and *C. multiramis* is the absence of distinct branch whorls upon the nodes. But it is possible that on those periods of the stems in which a series of long internodes occur the branches may have been irregularly produced.

DISTRIBUTION.

Bohemia.

Stephanian Series.

Horizon: ?

Locality: Nyran. (Böhmisches Museum, Prag).

Saxony.

Permian.

Horizon: Seam I.

Locality: Burgk, Augustus Pit. (Museum, Chemnitz).

Upper Westphalian Series.

Horizon: Seam "Grundflötz".

Locality: Lugau, Carl Pit. (Museum, Chemnitz; Pl. 124, fig. 1).

Austria.

Permian.

Horizon: ?

Locality: Segengottes Colliery near Rossitz. (Hofmuseum, Wien; Pl. 133, fig. 2, 3).

France.

Stephanian Series.

Horizon: Shales intercalated in the second Seam.

Locality: Commentry, Trench of l'Ouest. (*Arthropitys communis* RENAULT's Pl. 53, fig. 2; our Pl. 130, fig. 3; Mus. d'Hist. nat., Paris).

CALAMITES CUCULLATUS WEISS.

Pl. 121, fig. 2; Pl. 122, fig. 1.

1884 *Calamites cucullatus* WEISS, Steink. Calamar., II, Abh. z. Geol. Spezialk., V, 2, p. 117, Pl. 28, fig. 3.

1884 *Eucalamites cucullatus* WEISS, l. c., Explanation to Plate.

1911 *Calamites cucullatus* JONGMANS, Anleitung, I, p. 136, fig. 122.

DESCRIPTION.

Pith cast with short internodes, much contracted at the nodes and swelling gradually upwards till they meet the next node. Ribs narrow. Branch scars verticillate, four on each node.

REMARKS.

The two sides of the type specimen of this "species" are figured on our Pl. 121, fig. 2 and Pl. 122, fig. 1. It is badly preserved and does not possess sufficient characters on which to found a "good" species. It is probably a crushed specimen of the "*cruciatus*" group but is so imperfectly preserved that no critical comparison can be made between it and other members of the section.

DISTRIBUTION.

Germany.

Upper Westphalian Series.

Horizon: ?

Locality: Koenig Colliery near Saarbrücken. (Pl. 121, fig. 2; Pl. 122, fig. 1; Original of WEISS, Geolog. Landesanstalt, Berlin).

CALAMITES DISTICHUS RENAULT spec.

Text fig. 78.

1888 *Calamodendron distichum* RENAULT, Commentry, Atlas, Pl. 52, fig. 1 and Explanation to Plate.

1892 *Calamites cruciatus distichus* STERZEL, Rothlieg. im Plauenschen Grunde, Abh. K. Sächs. Ges. der Wiss., XIX, p. 59.

1911 *Calamites cruciatus distichus* JONGMANS, Anleitung, I, p. 147, fig. 129.

DESCRIPTION.

Internodes broader than long or longer than broad. Ribs straight, alternating at the nodes and ending in rectangular points with an oval tubercle at their upper ends. Branch scars two on each node, alternating on succeeding nodes, oval or circular, 1 cm. in diameter, with a central umbilicus and bearing fine radiating lines which converge towards the centre. The branch scars form four vertical rows on the stem.

REMARKS.

The branch scars have very much the character of those of *C. cruciatus* with which the general appearance of the ribs and tubercles somewhat agree but the ribs do not appear to converge to the branch scars as in typical *C. cruciatus*. It may possibly however be only a varietal form of that species, with two branch scars on each node.

The internodes are all short and of equal length with the exception of that at the base, which though imperfect is 7 cm. long.

DISTRIBUTION.

France.

Stephanian Series.

Horizon: ?

Locality: Commentry, Trench of l'Espérance. (Mus. Hist. nat., Paris).

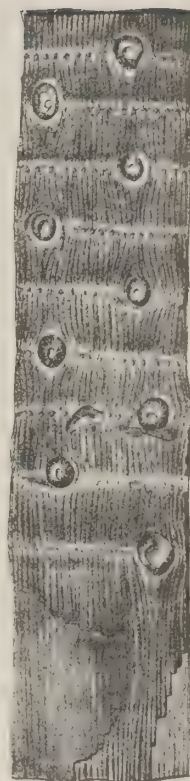


Fig. 78.

Calamites distichus REN.
Reduced copy
after RENAULT.

CALAMITES INFRACTUS GUTBIER.

Pl. 39, fig. 4; Pl. 131, fig. 2, 3; Pl. 132, fig. 1, 2; Pl. 133, fig. 1; Text fig. 79.

1835 *Calamites infractus* GUTBIER, (pars), Zwickau, p. 25, ? Pl. 3, fig. 1, (non fig. 4, 5, 6).

1849 *Calamites infractus* GUTBIER, Verstein. d. Rothlieg. in Sachsen, p. 8, Pl. 1, fig. 1, 4, (? 2, 3).

1862 *Calamites infractus* GEINITZ, Dyas, II, p. 134, Pl. 25, fig. 2.

1886 *Calamites infractus* STERZEL, Rothlieg. im nordwestl. Sachsen, pp. 17, 57, (? Pl. 8, fig. 1).

- 1864—65 *Calamodendron infractum* GOEPPERT, Foss. Fl. d. perm. Formation, Palaeontographica, XII, p. 183.
 1835 *Calamites articulatus* GUTBIER, Zwickau, Pl. 3, fig. 2, (? 3).
 1855 *Calamites cisti* GEINITZ, (non BGT.), (pars), Sachsen, p. 7, Pl. 12, fig. 4; (? Pl. 13, fig. 7).
 1869 *Calamites suckowi* SCHIMPER, (non BGT.), (pars), Traité, I, Atlas, Pl. 18, fig. 1.
 1888 *Calamodendron inaequale* RENAULT, Commentry, Atlas, Pl. 56, fig. 2; Text, II, 1890, p. 460.
 1911 *Calamites cruciatus infractus* JONGMANS, Anleitung, I, p. 154, fig. 133.
 1913 *Calamites cf. infractus* JONGMANS et KUKUK, Calam. Rhein. Westf. Steinkohlenb., Mededeel. Rijks Herbarium, Leiden, No. 20, p. 41, Pl. 8, fig. 4.

DESCRIPTION and REMARKS.

This species was founded by GUTBIER on several very imperfect casts all of which, in addition to being imperfectly preserved have suffered from crushing. The best preserved is perhaps that shown on his Pl. 1, fig. 4, which is reproduced on our Pl. 132, fig. 1. This represents a cast showing four internodes with portion of a fifth, having moderately strong and slightly undulated ribs, but their terminations are not seen. The length of the internodes varies from 7,5 cm. to 2,5 cm. The specimen is preserved in the round and each node bears five small branch scars. These are the only characters available for comparison with other species and it is impossible to make any satisfactory comparison between this specimen and any well defined species. Another of GUTBIER's original specimens is figured on our Pl. 131, fig. 2, 3.

We unite with this species *Calamodendron inaequale* REN. As far as one can judge upon such rather imperfectly preserved specimens, there is not any point of difference between *Calamodendron inaequale* and *Calamites infractus*. A reproduction of part of RENAULT's figure is seen in our Text fig. 79.

There are certain other casts which have come under our observation which may be provisionally referred to *C. infractus*. That given on Pl. 132, fig. 2 is the other side of the specimen figured by SCHIMPER as *C. suckowi* on his Pl. 18, fig. 1 and the chief points in which this agrees with *C. infractus* consist more in what the specimen does not show than in its possessing any critical distinctive character. It shows however that the upper terminations of the ribs bore large oval tubercles.

The other two specimens, figured on our Pl. 39, fig. 4 and Pl. 133, fig. 1 show more clearly defined branch scars and in one of them (Pl. 39, fig. 4) the larger tubercles at the upper end of the ribs are visible. Some specimens show a somewhat cellular ornamentation of the ribs.



Fig. 79.

Calamites infractus GUTB.
 (*Calamodendron inaequale* REN.)
 Copy of part of RENAULT's figure.

DISTRIBUTION.

Germany.

Permian.

Localities: Reinsdorf, Thonstein. (GUTBIER, 1849, Pl. 1, fig. 1, 4; our Pl. 131, fig. 2, 3; Pl. 132, fig. 1; Zwinger Museum, Dresden).

Porphyrtuff of Leukersberg near Rüdigsdorf, Sachsen. (STERZEL, 1886).

Augustus Pit in the Plauenscher Grund. (GEINITZ, 1855).

Walchia-Sandstone at Naumburg in the Wetterau. (GEINITZ, 1862).

France.

Stephanian Series.

Locality: Commentry, Trench of Chavais in the "Banc des roseaux". (RENAULT, 1888, *Calamodendron inæquale*).

Specimens provisionally referred to *C. cf. infractus* GUTBIER.

Germany.

Rheno-Westfalian Coalfield.

Westphalian Series ("Upper Gaskohle").

Horizon: Seam 5.

Locality: Colliery Graf Bismarck I. (Berggewerkschaftskasse, Bochum; Pl. 39, fig. 4).

Saar-Coalfield.

Westphalian Series.

Localities: Saarbrücken. (SCHIMPER'S *C. suckowi*, Pl. 18, fig. 1, our Pl. 132, fig. 2; Geolog. Institute, Strassburg).

Duttweiler near Saarbrücken. (GOLDENBERG Collection, Palaeobotanical Museum, Vetenskapsakademien near Stockholm; Pl. 133, fig. 1).

CALAMITES ELONGATUS RENAULT (*non* GUTBIER, *non* STERNBERG).

Pl. 132, fig. 3, 4.

1888 *Arthropitys elongata* RENAULT, Commentry, Pl. 52, fig. 2; (*non* Pl. 57, fig. 2); Text, II, 1890, p. 433.

1911 *Calamites elongatus* JONGMANS, Anleitung, I, p. 120, fig. 116.

DESCRIPTION and REMARKS.

Under the name of *Arthropitys elongata* RENAULT figures the fossil of which both sides are given on Pl. 132, fig. 3, 4. The specimen consists of two internodes, the lower of which enlarges towards its centre and contracts at both ends. The internodes bear

narrow ribs. Each node has two branch scars, one placed on each side but owing to the twisting of the specimen it is difficult to ascertain their original relationship to each other.

The fossil is very badly preserved and does not appear to us to possess any characters on which a satisfactory species can be founded.

The other specimen figured under this name by RENAULT is too fragmentary and imperfect to enable one to express any opinion on its affinities.

DISTRIBUTION.

France.

Stephanian Series.

Horizon: Under the floor of the "Grande Couche."

Locality: Commentry, Pit Sainte Aline. (Mus. d'Hist. nat., Paris).

CALAMITES SPECIES.

Pl. 90, fig. 1; Pl. 139, fig. 1.

REMARKS.

The specimen figured on Pl. 90, fig. 1 shows a pith cast, the greater portion of whose surface is covered by a thin layer of coal. It has one complete internode about 9 cm. long and two incomplete ones. At the base of the complete internode the coaly envelope has been removed from the cast which shows the ribs to be 1 mm. to 2 mm. wide, with a remarkably strong cross-hatched surface. This is clearly seen if the figure be examined with a lens. The coaly envelope exhibits on its surface the impression of the ribbing of the cast and at the nodes the narrow elongate tubercles are visible. On the upper node three circular mamillate branch scars about 0,5 cm. wide are seen. They show a very small umbilicus from which radiate diverging ridges. The branch scars have very much the form of those of *C. cruciatus* or *C. paleaceus*, but their distribution on the nodes differs entirely from that of the branch scars in those two species. It further differs from them in the strong cross-hatching of the surface of the ribs and in the narrow elongated tubercles. We know of no species with which this specimen can be identified. We refrain however from applying a specific name to it but we publish a figure and description in the hope that additional specimens may be discovered from which a complete description might be drawn up.

DISTRIBUTION.

Belgium.

Westphalian Series.

Horizon: Seam Dure.

Locality: Mariemont Collieries, Pit St. Arthur. (Pl. 90, fig. 1; Coll. DELTENRE).

Another fragment of a *Calamite* is given on Pl. 139, fig. 1. It consists of a fragment of an internode but broken in such a manner that its full length of 12,5 cm. can be seen. The fragment of the upper node shows one branch scar and at the lower node four branch scars are present. They are circular, about 1 cm. wide, with a very large umbilicus measuring 0,7 cm. in diameter and placed on the base of the scar. The remainder of the scar not occupied by the umbilicus, appears above it as a semilunate band, which is ornamented with very fine radiating striae that are distinctly seen when the scar is examined with a lens. The ribs are very faintly exhibited but have been divided by a double lined furrow. To the left of the figure a small fragment of the outer surface of the bark is impressed upon the matrix, which is ornamented by flexuous lines that produce a pseudoreticulate form of ornamentation. This ornamentation of the cortex resembles somewhat that of *C. dictyoderma* but the meshes are longer and not so well defined.¹⁾

Probably this specimen belongs to the *cruciatus*-group but even in that group we know of no species with which it can be identified.

DISTRIBUTION.

Bohemia.

Stephanian Series (Ottweiler Schichten).

Horizon: ?

Locality: Kotikov. (Pl. 139, fig. 1; Historisches Museum, Pilsen).

¹⁾ The specimen is shown in inverted position on the plate.

SECTION II.

DESCRIPTION.

Some of the ribs alternate at the nodes, while others pass straight over and may continue their course over more than one node.

REMARKS.

This group of *Calamites* holds an intermediate position between the *Calamites* proper and the *Asterocalamites* SCHIMPER. Although in *Calamites* SUCKOW, one may occasionally see the non-alternation of one or more ribs (Pl. 23, fig. 3), still this is rare and may be regarded as an accidental occurrence, whereas in section II, it is of constant occurrence and takes place to a great extent. In some cases in this section of *Calamites* as many of the ribs do not alternate as those which do and in no case do the ribs at any given node show one mode of behaviour only. So constant is this character that even small fragments of pith casts showing a node can be referred to their respective section without much difficulty.

It is a remarkable circumstance that these plants, which combine the characters of the two other groups of the *Calamariæ*, occupy a geological position intermediate between that of *Asterocalamites* and the true *Calamites*.

Although *Calamites roemeri* occurs in the basal division of the Lower Carboniferous this type is extremely rare at that low horizon and as far as one at present knows, all the other species of the group, if not entirely restricted to, are at least characteristic of the uppermost division of Lower Carboniferous rocks. They seem to represent a transitional group of plants which forms a bridge connecting the *Asterocalamites* to the *Calamites*.

CALAMITES ROEMERI GOEPPERT.

Pl. 40, fig. 1, 2; Pl. 47, fig. 1; Pl. 138, fig. 4; Pl. 143, fig. ? 5, 6; Pl. 156, fig. 4, 5.

1850 *Calamites roemeri* GOEPPERT, in ROEMER, Palaeontographica, III, 1, p. 45, Pl. 7, fig. 6.

1852 *Calamites roemeri* GOEPPERT, Flora des Uebergangsgebirges, Nov. Act. Ac. Caes. Leop. Car. Nat. Cur., Suppl. XXII, p. 118, Pl. 6, fig. 4, 5.

1854 ? *Calamites roemeri* GEINITZ, Hainichen-Ebersdorf, p. 32, Pl. 1, fig. 8, 9.

1869 ? *Calamites roemeri* LUDWIG, Palaeontographica, XVII, 3, p. 115, Pl. 21, fig. 5, 5a.

- 1873 *Calamites roemerii* FEISTMANTEL, Rothwaltersdorf, Zeitschr. Deutsch. Geol. Ges., XXV, p. 489, Pl. 14, fig. 2.
- 1894 *Calamites roemerii* KIDSTON, Proc. Roy. Phys. Soc. Edinburgh, XII, p. 248.
- 1850 *Calamites goepperti* ROEMER, Palaeontographica, III, 1, p. 45, Pl. 7, fig. 8.
- 1852 *Calamites dilatatus* GOEPPERT, Flora des Uebergangsgebirges, p. 119, Pl. 6, (?fig. 1, 2), fig. 3.
- 1877 *Calamites ostraviensis* STUR, Culmflora, II, Abh. K.K. Geol. Reichsanst., VIII, 2, p. 207 (101), Pl. 23(6), fig. 1–3, (?4); Text fig. 4, p. 118; (non Text fig. 6, p. 119).
- 1899 *Calamites ostraviensis* ZEILLER, Héraclée, Mém. Soc. géol. de France, Paléont., No. 21, p. 59.
- 1911 *Calamites ostraviensis* JONGMANS, Anleitung, I, p. 63, fig. 69.
- 1880 *Calamites radiatus* ROTHPLETZ, (non BGT.), (pars), Botan. Centralblatt, Vol. I, 3rd Gratis Beilage, p. 4, Pl. 1, fig. 6 and ? fig. 3.

DESCRIPTION.

Pith cast attaining a width of 8,5 cm. or more. Internodes generally broader than long. Ribs wide, on large specimens as much as 3 mm. broad, longitudinally striated. Some of the ribs alternate at the nodes, others pass straight over them. Those which alternate end in sharp points. Furrows separating the ribs straight, broad and prominent with a narrow but distinct central ridge. The tubercles at the upper extremities of the ribs are oval, large, at the lower end occasionally a few smaller tubercles occur. Branch scars verticillate and resting on or slightly extending over the node, small, about 1 cm. diameter, slightly distant, with an eccentric umbilicus.

On the upper half of the cup-like depression of the scar, radiating lines extend from the margin to the umbilicus. Beyond and surrounding the scar proper, is a faintly delimited narrow band.

REMARKS.

This fine species, although it has a wide distribution is not represented by many specimens in collections.

The best specimen known is that figured by STUR in his Culmflora, II, Pl. 23, fig. 1, under the name of *C. ostraviensis* which is reproduced on our Pl. 40, fig. 1, 2. The surface shown at fig. 1, especially at the lower node, exhibits very clearly the form of the terminations of the alternating ribs and here it is also to be observed that with few exceptions all the ribs alternate at this node. On the second node from the top of the same figure the ribs in the centre of the specimen pass straight over the node, while those towards the margin alternate. If these central ribs be traced to the uppermost node it would be seen that they also pass over, so that in this specimen some of the ribs pass over at least two nodes without any alternation. The other side of the specimen shown in fig. 2 is not so well preserved but illustrates more clearly the branch scars. These are circular, somewhat distant, with an eccentric umbilicus, which is placed on the nodal line, on both sides of which in some cases the scar extends. That shown at the extreme left margin of this cast, in addition to clearly exhibiting the oval eccentric umbilicus shows the radiating lines on the surface of the cup-like impression which surrounds it. These are much finer and more numerous than the ribs on the stem and seem to suggest that

whatever was the nature of the appendicular organ it was not sessile, and that these radiating lines are the impression of the ribs of the attached stalk or branch. In the only preserved verticil, nine or ten scars can be observed. The fine longitudinal striation of the outer surface of the ribs and the oval tubercles at their upper extremities are well seen on this specimen which only represents a portion of the cast, whose full length is about 25 cm. and shows one complete internode beyond that shown in the figure. The third node above the scar verticil has indications of a second branch whorl, but as the fracture passes through it, one cannot ascertain its detailed structure.

At fig. 1, Pl. 47 a second but smaller example of *C. roemerii* is illustrated. Here also can be observed the irregularity in the course of the ribs at the nodes, and the presence of the little central furrow passing down the centre of the furrow which divides the ribs.

The other specimens of *C. ostraviensis* given by STUR have not been examined except that shown at his fig. 4, but this is too imperfectly preserved to admit of a satisfactory reference to *Calamites roemerii*. We therefore exclude it from the synonymy.

The record of *Calamites ostraviensis* (= *C. roemerii*) from Héraclée by ZEILLER is based upon two small specimens figured here on Pl. 143, fig. 5, 6. That shown at fig. 6 seems to possess the characteristic furrow as well as the non-alternation of most of the ribs at the node and although the specimen is very fragmentary, it probably belongs to this species. The other example given at fig. 5 is too fragmentary for a satisfactory determination.

On Pl. 156, fig. 4, 5 a fragment of a *Calamites* is shown which we also place under *C. roemerii*. The course of the ribs is rather regular, however at the margin of the figure the irregularity, typical for this species, is indicated. The furrows show the characters of the species very clearly and the sharp pointed ribs are well seen on the specimen.

Of the specimens, which have been determined as *Calamites roemerii*, we have seen one example named by GOEPPERT himself and it is shown on Pl. 138, fig. 4. The characters exhibited by this example are absolutely identical with those of STUR's types of *C. ostraviensis* and therefore we unite the two species.

According therefore to the law of priority in nomenclature, STUR's name of *C. ostraviensis* must give place to that of *C. roemerii* GOEPPERT.

The plant was also described and figured by ROEMER (*Palaeontographica*, III, 1, p. 45, Pl. 7, fig. 8) under the name of *Calamites goepperti* ROEMER. But as GOEPPERT has shown that his *Calamites roemerii* described on the same page but figured on Pl. 7, fig. 6 is the same as *Calamites goepperti* ROEMER, GOEPPERT's name has the priority over *C. goepperti* ROEMER.

From the figures published by other authors under the name of *C. roemerii* GOEPPERT, those mentioned in our synonymy are specifically identical with the *C. ostraviensis* STUR. On the other hand, the specimen figured by VON ROEHL under the name of *C. roemerii* from the Westphalian is almost certainly referable to *C. undulatus* (*Palaeontographica*, XVIII, p. 15, Pl. 1, fig. 7a).

Under the name of *Calamites radiatus* BGT., ROTHPLETZ (*Culmflora Hainichen*,

Botan. Centralblatt, Vol. I, 3rd Gratis Beilage, 1880, p. 4, Pl. 1, fig. 6 and ? fig. 3) figures a specimen which is evidently referable to *C. roemeri*.

The sharp pointed terminations of the ribs, their wide furrows and striated surface with the large oval terminal tubercle and verticillate branch scars at once separate *C. roemeri* from all the other members of this section of *Calamites*.

From *Calamites undulatus* STERNBERG, it is also easily distinguished by the wide furrows, large tubercles, the absence of cross-hatching on the ribs as well by its more prominent branch scars and by the non-alternation of many of the ribs at the nodes.

WEISS (Steink. Calamarien, II, p. 125) united *C. ostraviensis* STUR (Pl. 23, fig. 1) with *C. acuticostatus*. However *C. roemeri* is distinguished from the latter species (which we unite with *C. undulatus*) by the characters mentioned above.

DISTRIBUTION.

Austria.

Lower Carboniferous.

Ostrauer Schichten.

Horizon: Roof of the Flora Seam.

Locality: M. Ostrau, Heinrich-Schacht, No. X. (STUR's Pl. 6, fig. 1; Pl. 23, fig. 1, 2, 3; our Pl. 40, fig. 1, 2).

The other localities mentioned by STUR are not given here as we have not seen the specimens and in one case the original specimen (Pl. 23, fig. 4) was indeterminable. (K.K. Geol. Reichsanstalt, Wien).

Great Britain.

Carboniferous Limestone Series.

Upper Limestone Group.

Locality: Rosehill Bore, Pleau, Stirlingshire. (Pl. 47, fig. 1; Coll. KIDSTON, 3969).

Calci ferous Sandstone Series.

Locality: Water of Leith below Redhall Milldam, Midlothian. (Coll. KIDSTON, 4479 and 4480, mentioned by KIDSTON, 1894, as *C. roemeri* GOEPP.).

Germany.

Kohlenkalk.

Locality: Near Rothwaltersdorf in Lower Silesia. (FEISTMANTEL).

Culm.

Localities: Harz, Rosenhofer Gangzug in the younger "Grauwacke". (ROEMER's *Cal. goepperti*).

Harz, Innerstethal and Grund in the younger "Grauwacke". (*Cal. roemeri* GOEPPERT in ROEMER, 1850).

Friedersdorf, Bögendorf near Schweidnitz, Berndau near Leobschütz in Upper Silesia. (GOEPPERT, 1852).

Eimelrod in Oberhessen "im Posidonomyenschiefer". (GOEPPERT, 1852).

? Hainichen, Ottendorf near Hainichen and near Berthelsdorf. (GEINITZ, 1854).

Adolph Pit near Berthelsdorf. (ROTHPLETZ, 1880).

? Kombach near Biedenkopf "im flözleeren Sandstein". (LUDWIG).

Steinkunzendorf. (*C. roemeri* GOEPPERT, our Pl. 138, fig. 4).

Netherlands.

Slightly over "Kohlenkalk" (Carboniferous Limestone Series).

Horizon: Shales at 1054 M.

Locality: Bore 17, Woensdrecht, near Bergen op Zoom, Netherlands, together with *Calamites cf. cistiiformis* STUR. (Pl. 156, fig. 4, 5).

Minor Asia.

Culm.

Horizon: Seam Daadji.

Locality: Héraclée, Aladja Agzi. (ZEILLER; our Pl. 143, fig. 6, ? 5).

Belgium and Russia.

The plant has also been recorded by RENIER (Ann. Soc. géol. Belgique, XXXV, 1908, p. 120) from the H_{1b} Horizon in Belgium, and by ZALESSKY (Dombrowa, Mém. du Comité géol., Nouv. Sér., Livr. 33, 1907), but figures of the specimens have not yet been published.

CALAMITES CISTIIFORMIS STUR.

Pl. 141, fig. 6; Pl. 142, fig. 2, ? fig. 3; Pl. 143, fig. 7; Pl. 144, fig. 4; Pl. 145, fig. 1, 6;
Pl. 147, fig. 1, 2, 3, 4.

1877 *Calamites cistiiformis* STUR, Culmflora, II, Abh. K.K. Geol. Reichsanst., Wien, VIII, 2, p. 200, Pl. 4 (21), fig. 5, 6.

1877 *Calamites ramifer* STUR, (*pars*), Culmflora, II, Pl. 4 (21), fig. 4.

1899 *Calamites ramifer* ZEILLER, (*pars*), Héraclée, Mém. Soc. géol. de France, Paléont., No. 21, p. 60.

1911 *Calamites cisti* JONGMANS, (*non* BGT.), (*pars*), Anleitung, I, p. 185.

DESCRIPTION.

Internodes usually longer than broad, attaining a width of 7 cm. or more. Ribs narrow, straight, alternating or passing straight over the nodal line. When they alternate, they end in sharp points. Tubercles oval, only observed on the upper ends of the ribs. Furrows straight, bounded by two distinct lines. Surface of ribs finely striated longitudinally with occasionally a very slight indication of cross-hatching. Branch scars very rare, small, placed on the nodal line.

REMARKS.

The original specimen of STUR's *Calamites cistiiformis*, Pl. 21, fig. 6 is reproduced here on Pl. 144, fig. 4. It shows an impression of the cast and exhibits 9 complete and 2 incomplete internodes of almost equal length, the shortest being 2 cm. and the longest 2,1 cm. long. The width of the cast is about 2 cm. The cast impression shows clearly the alternation of some of the ribs at the nodes and the passing straight through them of some of the other ribs. A few of the ribs show a small oval tubercle on their upper end. No branch scars are present. A small portion of this example is enlarged two times on Pl. 145, fig. 1.

On Pl. 142, fig. 2 and Pl. 141, fig. 6 a figure of the original specimen described by STUR as *Calamites ramifer* on his Pl. 21, fig. 4, is given. This we place under his *Calamites cistiiformis*, as the characters exhibited on the specimen do not seem to differ in any point from those he gives as characteristic of the latter species except in the occurrence of a branch scar. This scar is very small, somewhat ill defined and wants the prominence and size of those of *C. ramifer*. The ribbing of this specimen is also much more that of *C. cistiiformis* than of *C. ramifer*.

A few additional figures of this somewhat obscure species are added here. That on Pl. 147, fig. 1 shows in its upper part the impression of the cast on the matrix and in its lower part the upper surface of the cast. The internodes are much longer than in the specimens just described, being from 5,5 to 6 cm. long and about 3 cm. wide. A portion of the specimen enlarged two times is given at fig. 2 of the same plate. Here the sharp points of the alternating ribs and the double line of their dividing furrows are clearly seen, a character also well exhibited on STUR's specimen, figured on our Pl. 141, fig. 6.

Another fragment is given on Pl. 147, fig. 3, of which a portion is enlarged two times at fig. 4. This latter shows very distinctly the sharp termination of the ribs and the double lined furrows. The magnification is scarcely sufficiently high to show the fine striation of the outer surface of the ribs.

On Pl. 142, fig. 3 a small specimen is shown giving off two branches on the opposite sides of the node. The ribs on the specimen show the double lines limiting the furrows, characteristic of *Calamites cistiiformis* and it possibly belongs to that species, though the specimen is too fragmentary for a satisfactory determination.

We also refer to this species some of the specimens identified by ZEILLER as *Calamites ramifer*. They are very imperfect but interesting on account of the locality at which they were collected. They agree perfectly with this species as far as one is enabled to compare them and two specimens are figured on Pl. 143, fig. 7 and Pl. 145, fig. 6. The third specimen of *C. ramifer* in ZEILLER's collection is regarded by us as indeterminable (Pl. 145, fig. 5).

*Calamites cistiiformis*¹⁾ has been united by some authors to *C. cisti* but it differs in

¹⁾ STERZEL, Karbon und Rotliegendfl. Baden, Mitt. d. Grossh. Badischen geol. Landesanst., V, 1907, p. 705, 706; JONGMANS, Anleitung, I, 1911, p. 185.

the constant occurrence of some of the ribs passing straight over the nodal lines in association with others which alternate at the nodes in the usual manner. The ends of the ribs where they show an alternation are always sharp pointed whereas they are rounded in *C. cisti*.

From *Calamites ramifer* it differs in the ribs being narrower, apparently always straight and in its smaller and more rarely occurring branch scars.

DISTRIBUTION.

Austria and Germany.

Lower Carboniferous.

Ostrauer Schichten.

Horizon: Seam "II. Liegend Flötz".

Locality: Witkowitz, Tiefbau. (Pl. 144, fig. 4; Pl. 145, fig. 1).

Horizon: Seam Daniel.

Locality: Privoz, Pit Franz. (Pl. 141, fig. 6; Pl. 142, fig. 2; *Calamites ramifer* STUR, pars).

Other localities given by STUR, but from which we did not see the specimens are:

Horizon: ?

Localities: Peterswald.

Jaklovec in Poln. Ostrau, Pit No. 5.

Horizon: Roof of the Urania Seam.

Locality: Zwierzina Colliery near Poln. Ostrau, Salm Pit.

Great Britain.

Carboniferous Limestone Series.

Upper Limestone Group.

Horizon: 30—40 feet below No. 6 Limestone.

Locality: Lower side of old bridge, Bilston Burn near Polton, Midlothian. (Pl. 147, fig. 1, 2).

Horizon: Near the top of Bishopbriggs Sandstone.

Locality: No. 1 Bore, Cumbernauld, $\frac{3}{4}$ mile N. E. of Cumbernauld Railway Station, Stirlingshire. (Pl. 147, fig. 3, 4).

Horizon: Bed between No. 4 and 5 Limestones.

Locality: Shore at Cuthill between Musselburgh and Prestonpans, Haddingtonshire. (Coll. KIDSTON, 3820).

Horizon: Immediately beneath the Orchard Limestone.

Locality: New Braidbar Quarry, Giffnock, Renfrewshire. (Coll. KIDSTON, 4829).

Horizon: 63½ fathoms from surface.

Locality: Milton Bore, Springburn, Glasgow. (Coll. Geol. Surv. of Scotland, No. T 3400^E).

Netherlands.

Lower Carboniferous.

Horizon: Slightly over "Kohlenkalk".

Locality: A small specimen collected at Bore No. 17, Woensdrecht, near Bergen op Zoom, Noord-Brabant, at a depth of 1054 M., is probably referable to this species, but too imperfect for a definite determination. *Calamites roemeri* was discovered on the same horizon. The occurrence of this group of *Calamites* indicates that these rocks are of Lower Carboniferous age.

Asia Minor.

Lower Carboniferous.

Horizon: Seam Ali Mollah.

Locality: Héracleé, Coslou. (*C. ramifer* ZEILLER, non STUR; Pl. 143, fig. 7; Pl. 145, fig. 6).

CALAMITES TAITIANUS KIDSTON et JONGMANS nov. spec.

Pl. 147, fig. 5; Pl. 148, fig. 1; Pl. 149, fig. 1, 2, 3, 4, 5.

DESCRIPTION.

Pith cast 8 cm. or more wide. Internodes broader than long, more rarely longer than broad. Ribs attaining a width of 2,5 mm., alternating at the nodes or passing straight over them. Where the ribs alternate their terminations are rounded or bluntly pointed. Ribs longitudinally striated. Tubercles obscure. Furrow straight, broad and flat. Branch scars large, rounded or transversely suboval, attaining a diameter of 2,2 cm. and forming a pit-like cavity down whose sides the ribs extend, leaving a small clear umbilical area. Branch scars in two opposite rows, one on every second node though a greater interval may sometimes occur between them.

REMARKS.

Our largest example of this species is shown on Pl. 148, fig. 1. The specimen shows 7 nodes, of which the internodes vary from 2,3 cm. to 3 cm. in length with a width of fully 8 cm. This specimen shows very clearly the characters of the species and exhibits well the non-alternation of many of the ribs at the nodes. Where the ribs do alternate, they show a somewhat blunt termination. The umbilicus of the branch scar is placed upon the nodal line so that the cup-like cavity extends partly over both internodes.

Another but somewhat smaller specimen is seen on Pl. 149, fig. 1. On this example the bending in of the ribs at the margins of the scar gives the appearance as if its lateral margins were produced as two points, but this is really not the case as the true form of the scar is round and is limited in the figure by the lighter coloured circular area.

A portion of the surface of the example given on Pl. 149, fig. 1 is enlarged two times at fig. 4 of the same plate to show the arrangement of the ribs at the nodes and their striated outer surface.

Figs. 2 and 3¹⁾ on Pl. 149 give the two sides of a compressed cast. This shows the occurrence of the branch scars on the alternate nodes on the two sides of the cast. The branch scar is well seen and the central boss indicates the size of the pith cavity of the attached organ which is now filled in with the matrix. The circular form of the branch scar is very clearly shown as well as the inward bending of the ribs on its margin.

The apparent tubercles at the upper extremities of the ribs on this figure are caused by the rubbing off at that part of a slight carbonaceous film which covers the greater part of the specimen and neither on this nor on any other example have we observed any clear evidence of their presence.

A smaller and somewhat crushed specimen is seen on Pl. 147, fig. 5. Here there are 9 complete internodes preserved but on the exposed surface, on only one of the nodes is a branch scar visible. Had this specimen possessed a branch scar on every alternate node as in the last two examples described, one would have expected to find another scar on the fourth node higher up. There is however no trace of it, so it is probable that some variation occurred in the distribution of the branch scars.

A small branching specimen, whose chief point of interest is the presence of the attached alternate branches, is given on Pl. 149, fig. 5.

The only plant with which *Calamites taitianus* could be confused, is the *Calamites carinatus* STERNBERG. (*Calamites ramosus* ARTIS). In this latter species however, each node bears usually two, rarely one or three scars.

We have pleasure in naming this specimen after Mr. DAVID TAIT, of the Staff of the Geological Survey of Scotland, to whose careful collecting we are indebted for much information about that section of *Calamites* to which *C. taitianus* belongs.

DISTRIBUTION.

Great Britain.

Lower Carboniferous.

Carboniferous Limestone Series.

Horizon: Lower Group of Roslin Sandstone, Basal beds of "Millstone Grit".

Localities: Levenhall Shore, below high water mark, first exposure west of stream at Ravenshaugh Bridge, Midlothian.

River South Esk, a quarter of a mile north west of Arniston Mains, Midlothian.

River Esk, right bank, opposite No. 4 House of Roslin Powder Mills, Midlothian.

Roslin Powder Mills, upper side of road behind No. 5 House, Midlothian.

¹⁾ Fig. 3 is placed on the Plate in inverted position.

Glencorse Barracks, 1½ miles north east of Penicuik, in the stream which flows eastwards into the North Esk at a point 20–30 yards from its junction with that river, Midlothian.

River North Esk, left bank ¼ mile of Easter Auchindinny Bridge, Midlothian. Quarry, Garngad Road, to East of Garngad Railway Station, Glasgow. Balornock Bore, Springburn, Glasgow.

Upper Limestone Group.

Horizon: 30–40 feet below No. 6 Limestone.

Locality: Left bank of stream on lower side of old stone bridge, Bilston Burn, near Polton, Midlothian. (Pl. 147, fig. 5; Pl. 148, fig. 1; Pl. 149, fig. 1, 2, 3, 4, 5).

Horizon: Beds between No. 4 and No. 5 Limestones.

Locality: Cuthill Shore, between Musselborough and Prestonpans, Haddingtonshire.

Horizon: ?

Locality: A 100 to 150 yards upwards from old stone bridge, Bilston Burn, Polton, Midlothian.

(The above localities for this species were all discovered by Mr. D. TAIT of the Geological Survey of Scotland. Specimens are preserved in the collection of the Geological Survey).

Limestone Coal Group = Edge Coal Group.

Horizon: From strata somewhere below Bluetour Coal and Macdonald Limestone.

Locality: Shaft sinking, Grasshill No. 2 Pit, Glenbuck, Ayrshire. Collected by Mr. A.W. WYTE.

CALAMITES HAUERI STUR.

Pl. 142, fig. 5, 6¹⁾; Pl. 143, fig. 3, 4; Pl. 144, fig. 2, 3; Pl. 145, fig. 2, 3, 4, 7; Pl. 146, fig. 1, 2.

1877 *Calamites haueri* STUR, Culmflora, II, Abh. K. K. Geol. Reichsanstalt, Wien, VIII, 2, p. 195, Pl. 19, fig. 7; Pl. 22, fig. 2, 3 a and b; Text fig. 19 and 20,

1911 *Calamites suckowi* JONGMANS (*pars*), Anleitung, I, p. 170, fig. 142.

DESCRIPTION.

Pith cast attaining a large size. Internodes generally broader than long, sometimes slightly longer than broad. Ribs attaining a width of 4 mm., separated by straight or flexuous furrows with a large tubercle situated at their upper extremity. The ribs pass straight over the internodes without any alteration of their course or alternate and end in sharp points. Surface of ribs show cross-hatching when well preserved. Branch scars small in proportion to the size of the cast, occurring irregularly and placed immediately

¹⁾ By a misprint this figure 6, the counterpart of fig. 5, has been numbered on the plate as fig. 2. (Right lower corner of plate).

above the nodal line, transversely oval and attaining a diameter of 1 cm., to which the ribs generally slightly converge. Sometimes two occur on the same node on the exposed surface of the cast, more frequently only one is present. On some examples branch scars occur on all the nodes though occasionally they are separated by one or more internodes on which no branch scars are present.

Basal portion of stem composed of internodes diminishing in size and terminating in a blunt point; ribs broad with large terminal tubercles.

REMARKS.

Our largest specimen, of which a portion is shown on Pl. 146, fig. 2 is about 52 cm. long and about 10 cm. wide. At several parts of the figure the ribs are seen to pass straight over the nodes while at other points they alternate and terminate in sharp points. The uppermost and third internode of the figure show each a single branch scar situated immediately above the nodal line and towards which the ribs slightly converge. On this specimen the majority of the ribs are straight, but a few on the second internode from the top are separated by flexuous furrows.

A portion of another specimen about 41 cm. long is given on Pl. 146, fig. 1. A convergence of the ribs towards the node is seen at two places on the second node from the top of the figure and also on the fourth node, but they are not accompanied by the formation of a branch scar. Here as in the previous example, ribs are seen to alternate at certain points and at others to pass straight over the nodes. The majority of the ribs are here also separated by straight furrows although they are occasionally flexuous.

A small example given on Pl. 145, fig. 4 shows very clearly the form and position of the branch scars and the tubercles on the upper ends of the ribs.

Another specimen given on the same plate at fig. 2 illustrates well the formation of the branch scars and the convergence of the ribs at the nodal line. An enlargement of this is given at fig. 3.

The fragment figured on Pl. 143, fig. 3 shows the ornamentation of the surface of the ribs as well as the flexuous course of the furrows. A portion of this specimen is enlarged two times at fig. 4.

At fig. 7, Pl. 145 a few ribs of another specimen are enlarged two times to show their ornamentation and the flexuous character of the dividing furrows.

The termination of a stem is given on Pl. 142 where at figs. 5 and 6 its two sides are seen. These show the short terminal internodes, broad ribs and large tubercles.¹⁾

The original of STUR's Pl. 19, fig. 7 is given on Pl. 144, fig. 2, 3. In STUR's figure the two sides of the specimen are flattened out and represented in the same plane. Here the two sides are given separately. This specimen is not very well preserved, but shows the following important characters, the alternation and non-alternation of the ribs at the nodes, their terminating in sharp points where they alternate, their large tubercles and the small branch scars situated immediately above the nodal line.

¹⁾ See footnote previous page.

The other specimens figured by STUR are not so perfect and not typical for his species and therefore are not reproduced here.

Most authors, who have spoken on *Calamites haueri* STUR have regarded it as referable to *C. suckowi* ¹⁾ and with only STUR's material before them such a conclusion might well be arrived at. We have however been fortunate in securing much better preserved examples which agree with all the characters, shown on STUR's specimens. These characters however can only be fully appreciated when one is in possession of a series of well preserved examples.

From *Calamites suckowi* BGT., STUR's *Calamites haueri* is clearly distinguished by its ribs frequently non-alternating at the nodes, by their sharp pointed terminations, by the surface ornamentation and by the form and frequent occurrence of the branch scars.

From *Calamites undulatus* it differs in the large terminal tubercles and the form and arrangement of the branch scars as well as in the frequent non-alternating of the ribs at the nodes.

DISTRIBUTION.

Lower Carboniferous.

Austria.

Ostrauer Schichten.

Horizon: ?

Locality: Fürstl. Salm'sche Kohlengrube near Poln. Ostrau, Peterswald, Eugen Pit. (STUR's Pl. 2, fig. 7; our Pl. 144, fig. 2, 3; K.K. Geolog. Reichsanstalt, Wien).

Great Britain.

Carboniferous Limestone Series.

Horizon: Lower Group of Roslin Sandstone=Basal beds of "Millstone Grit".

Localities: Levenhall Shore, below high water mark, first exposure west of stream at Ravenshaugh Bridge, Midlothian.

River South Esk, $\frac{1}{4}$ mile north west of Arniston Mains, Midlothian.

River Esk, right bank, opposite No. 4 House of Roslin Powder Mills, Midlothian.

Glencorse Barracks, $1\frac{1}{2}$ miles north east of Penicuik, in stream which flows into the North Esk at a point 20—30 yards from its junction with that river, Midlothian.

¹⁾ WEISS, Steinkohlen-Calamarien, II, Abh. z. Geolog. Spezialk., V, 2, p. 129; STERZEL, Flora des Rothliegenden im Plau. Grunde, Abh. mathem. phys. Classe, K. Sächs. Ges. d. Wiss., XIX, 1893, p. 87; STERZEL, Karbon. und Rotliegendflora im Grossherzogt. Baden, Mitt. Bad. Geol. Landesanst., V, 1907, p. 705 and JONGMANS, Anleitung, I, p. 164, have united STUR's figures with *C. suckowi* (cf. however JONGMANS and KUKUK, Calam. d. Rhein. Westf. Kohlenbeckens, Mededeel. Rijks Herbarium, Leiden, No. 20, 1913, p. 22, Footnote). GEINITZ, Calamarien, Mitt. a.d. K. mineral. geol. und prähist. Museum zu Dresden, XIV, 1898, p. 3, brings STUR's Pl. 22, fig. 2, 3 a, b to *C. suckowi* though with some doubt and thinks that STUR's Pl. 19, fig. 7 may probably belong to *Calamites ramosus*, with which species however it has no resemblance.

Upper Limestone Group.

Horizon: 30—40 feet below No. 6 Limestone.

Locality: Lower side of old stone bridge, Bilston Burn near Polton, Midlothian.
(Pl. 142, fig. 5, 6; Pl. 143, fig. 3, 4; Pl. 145, fig. 2, 3, 4, 7; Pl. 146, fig. 1, 2; Coll. KIDSTON).

Horizon: 24 fathoms above Calmy Limestone.

Locality: Rosehill Diamond bore, Plean, Stirlingshire.

Horizon: ?

Locality: In stream course forming parish boundry, about 150 yard a little south of east of Newhouse, 1½ miles north west of Stonehouse, Lanarshire.

(The above localities for this species were all discovered by Mr. D. TAIT. Specimens are preserved in the collection of the Geological Survey of Scotland).

CALAMITES RAMIFER STUR.

Pl. 141, fig. 4, 5; Pl. 142, fig. 1 and 4; Pl. 143, fig. 1, 2; Pl. 144, fig. 1.

1877. *Calamites ramifer* STUR, (*pars*), Culmflora, II, Abh. K. K. Geol. Reichsanst., Wien, VIII, 2, p. 188, Pl. 20, fig. 3, 3b, 4; Pl. 21, fig. 2, 3, (*non* 4); (*exclude* Textfig. 15, 16, 17, on p. 155, 156, 18 on p. 192).

1911. *Calamites ramosus* JONGMANS, (*pars*), Anleitung, I, p. 115, fig. 113, 114, 115, (on p. 119).

DESCRIPTION.

Pith cast attaining a width of 7 cm. or more. Internodes from 4 to 18 cm. in length. Ribs straight or flexuous, and attaining a width of 2,5 mm. but are usually much narrower. Tubercles at their upper extremities oval. Surface of ribs finely striated longitudinally. At the nodes some of the ribs pass straight over, while others alternate and end in sharp points. Furrows straight or flexuous and separated by a single line. Branch scars usually occur on each node and vary in number from 1 to 5. Branch scars small, oval or subcircular and attaining a diameter of about 5 mm.

REMARKS.

Two of STUR's original types are given on Pl. 141, fig. 4 and 5 and Pl. 142, fig. 1. That illustrated at fig. 4 shows one node and portions of two internodes. As this cast is removed from the matrix, one is enabled to examine both surfaces. The node on this example shows only one branch scar, although towards the left margin of the figure a few ribs are seen to converge towards the nodal line but they do not seem to be associated with a branch scar. The internodes here must have been very long as one of them though incomplete measures fully 15 cm. The figure also shows clearly the single dividing line between the furrows, which in this case are straight.

Another of STUR's types is seen at fig. 5. This specimen contains two nodes separated by an internode of 18 cm. A portion of the other side of the specimen, is shown on Pl. 142, fig. 1, where also is seen a single nodal branch scar.

Several other specimens are here illustrated to further exhibit the characters of the species. Fig. 1, Pl. 143 and fig. 1 on Pl. 144 show two sides of a pith cast. It contains three perfect internodes about 7,5 cm. long. Only two of the nodes are perfect and of these one bears five and the other four or five branch scars. Of the node bearing the five scars, which is the upper one of the two perfect nodes at fig. 1, Pl. 143, one scar is of smaller size than the others and placed about 1 cm. from one of normal dimensions. This example also shows very beautifully the through going and alternations of the ribs at the nodes, with their pointed terminations. The majority of the ribs are here flexuous, though many straight ones are also seen on this fossil. The impression of this specimen, shown on Pl. 142, fig. 4, illustrates well the form and position of the branch scars. An enlargement of part of the cast seen on Pl. 143, fig. 1, is given at fig. 2 of the same plate to show the form of the tubercles and branch scars, as well as the course of the ribs at the node.

We exclude from this species STUR's Pl. 21, fig. 4, which we place under *Calamites cistiiformis*. An examination of the originals of his text figures 15, 16, 17 has shown that these are quite indeterminable on account of their very imperfect preservation. We also exclude the original of his text fig. 18 as it is impossible to ascertain the true form of the branch scars, and further the furrows dividing the ribs on this specimen seem to be distinctly double lined, a form of furrow not known to occur in *C. ramifer*. It is therefore improbable that this example can belong to that species.

Under the name of *Calamites ramifer* LESQUEREUX seems to include two distinct species. (Coalflora I, p. 23; III, p. 703, Pl. 91, fig. 4, 4a). The casts referred to in the earlier description from the subconglomerate shale, Campbell's Ledge, Pittston, are probably referable to *Cal. carinatus* STERNBERG, as a specimen from this locality named *C. ramifer* by LESQUEREUX, received from the late Mr. R. D. LACOE, in KIDSTON's collection (No. 1397) appears to belong to *Calamites carinatus* and although the branch scar on this example is not sufficiently well preserved to admit of a definite determination, the specimen is certainly not the *C. ramifer* of STUR.

The other plant referred to this species by LESQUEREUX is an *Annularia* but there is absolutely no evidence to show that the specimens have any connection with *C. ramifer* STUR.¹⁾

Of the three specimens which ZEILLER (Mém. Soc. Géol. France, Paléont., No. 21, p. 60) referred to *Calamites ramifer* from Héraclée, two of these we refer to *Calamites cistiiformis*. (See Pl. 143, fig. 7; Pl. 145, fig. 6). The other is figured on our Pl. 145, fig. 5, but seems to be too imperfect for a specific determination.

¹⁾ WHITE, Pottsville, 20th Ann. Rept. U. S. Geol. Surv., Pt. II, p. 898 unites *C. ramifer* LESQ. III, p. 703 with *Annularia latifolia* DAWSON.

From specimens of *A. latifolia* DAWSON in KIDSTON's Collection, No. 117, 118 and 119, sent by the late Sir WILLIAM DAWSON, No. 117 and 118 show a great similarity to *A. sphenophylloides* and No. 119 to *A. stellata*. Evidently more than one species is included under the name of *Annularia latifolia* DAWSON.

Calamites ramifer has been united with *C. carinatus* STERNBERG (*C. ramosus* ARTIS) by several authors (JONGMANS, Anleitung, I, p. 115; RYBA, Jahrb. K. K. geol. Reichsanst., Wien, 1903, LIII, p. 359; WEISS, Steinkohlen Calamarien, II, p. 101 [187]). This opinion has arisen through the imperfection of the material available for study by these authors.

GEINITZ (Calamarien, Mitt. a. d. K. mineral geol. und praehist. Museum, Dresden, XIV, p. 3) unites the specimens figured on STUR's plates with *Calamites roemeri* GOEPPERT, but the two species are essentially distinct.

DISTRIBUTION.

Austria.

Lower Carboniferous.

Ostrauer Schichten.

Horizon: ?

Locality: Ida-Schacht in Hruschau. (STUR's Pl. 20, fig. 3; our Pl. 141, fig. 5 and Pl. 142, fig. 1; K. K. Geolog. Reichsanstalt, Wien).

Horizon: Seam 8. Liegendflötz.

Locality: Salomons Pit in M. Ostrau. (STUR's Pl. 20, fig. 4; our Pl. 141, fig. 4; K. K. Geolog. Reichsanstalt, Wien).

Horizon: Seam 11.

Locality: Jaklovec. (STUR's Pl. 21, fig. 3).

Horizon: Eduard Seam.

Locality: Witkowitz, Tiefbau. (STUR's Pl. 21, fig. 2).

STUR gives other localities for this species but as some of his specimens have been found to be indeterminable and others we have been unable to see, we do not include them in our list of localities for *C. ramifer*.

Great Britain.

Carboniferous Limestone Series.

Horizon: Lower Group of Roslin Sandstone=Basal beds of "Millstone Grit".

Localities: River South Esk, 1/4 mile northwest of Arniston Mains, Midlothian.

River Esk, right bank opposite No. 4 House of Roslin Powder Mills, Midlothian.

Upper Limestone Group.

Horizon: 30—40 feet below No. 6 Limestone.

Locality: Left bank of stream on lower side of old stone Bridge, Bilston Burn near Polton, Midlothian. (Pl. 142, fig. 4; Pl. 143, fig. 1, 2; Pl. 144, fig. 1; Coll. KIDSTON, No. 4397; 4396).

Horizon: ?

Locality: 100 to 150 yards up stream from old stone Bridge, Bilston Burn near Polton, Midlothian.

CALAMITES APPROXIMATIFORMIS STUR.

Pl. 141, fig. 1, 2, 3; Text fig. 79, 80.

1877 *C. approximatifomis* STUR, Culmflora, II, Abh. K.K. Geol. Reichsanst., Wien, VIII, 2, p. 202, Pl. 21, fig. 7; Pl. 22, fig. 4.

1877 *C. approximatus* STUR (non BGT.), Culmflora, II, p. 204, Pl. 21, fig. 8.

1901 *Calamophyllites cf. approximatus* POTONIÉ, Silur und Culmflora, p. 99, fig. 57.

1911 *C. suckowi* JONGMANS, (pars), Anleitung, I, p. 173, fig. 144.

DESCRIPTION.

Internodes very short, broader than long, and frequently varying in length on the same specimen. Ribs broad, rarely alternating at the nodes and much more frequently passing straight over them without any alteration in their course. Where the ribs alternate at the nodes, they end in sharp points. Upper surface of ribs ornamented with longitudinal striation and occasionally showing cross-hatching. Branch scars small, circular or suboval, irregularly placed and usually unaccompanied by any convergence of the ribs towards them. Occasionally a few of the ribs are seen to converge to a point on the nodal line, but do not show any indication of connection with a branch scar. On the upper ends of the ribs large tubercles occur and occasionally smaller tubercles are seen on their lower ends.

REMARKS.

The specimen shown at fig. 1 is the original of STUR's Pl. 22, fig. 4. It is not very well preserved and does not show the characters of the cast so distinctly as the example given at fig. 2. On the specimen seen at fig. 1 the internodes are of almost equal length, being from 2 cm. to 2,25 cm. long with a width of about 4 cm. The ribs bear very fine longitudinal striations but the cross-hatching is only indistinctly seen. At their upper end they bear a round or slightly oblong tubercle. Occasionally a slight convergence of some of the ribs takes place at the nodes but this is not associated with a branch scar. On the other side of the specimen from that figured, the uppermost node bears two branch scars, one at the margin and the other towards the centre of the cast, and on the fifth node from the top, another branch scar is seen.

The example figured by STUR on his Pl. 21, fig. 7 is given at our figure 2. Here the ribbing is well shown. The ribs are wide in proportion to their length and when examined with a lens show a strongly marked cross-hatching especially on the ribs at the upper end of the specimen. The internodes vary in length, the upper ones being 75 mm. long, while those towards the lower end of the fossil are 1,50 cm. long. The part of the specimen above the crack shows the outer surface of the cast, while the portion below it, is the impression of the cast on the matrix. On the portion above the crack two branch scars are seen, one on the second and the other on the fifth node; on the impression two branch scars are also seen, one on the eighth and the other on the twelfth nodal line from the top. The tubercles at the upper ends of the ribs though present, are not very clearly defined.

The specimen figured by STUR as *C. approximatus*, on his Pl. 21, fig. 8 is reproduced at our fig. 3. Here the nodes are all short, their lengths varying from 8 mm. to 11 mm. and their width from 4 to 4,5 cm. The tubercles are seen at several of the nodes, and are specially well exhibited at the fifth node from the base, where also at the lower ends of the ribs there appear to be smaller tubercles. An occasional convergence of the ribs takes place on the nodes. The carbonaceous layer, of which fragments are seen adhering to the pith cast, is about 1 mm. thick.

The fifth specimen of *Calamites approximatifomis* STUR, known to us is given natural size at text figure 79 and a small portion is enlarged two times at text figure 80. The cast is 26,75 cm. long and throughout its length maintains a width of 2,80 cm. The internodes are short, varying from 1,55 to 2,10 cm. in length. The ribbing is very strong and the ribs, which are divided by prominent furrows, are longitudinally striated but do not show any cross-hatching. Its absence is probably due to the condition of preservation.

The branch scars are small, circular, and about 3 mm. in diameter. On the exposed surface of this pith cast, generally only one occurs on each alternate node but this is not an invariable rule, for at one part of the fossil a branch scar is present on each of two consecutive nodes and on another part, two branchless nodes are inserted between those bearing branch scars. Their distribution and the length of the internodes is seen in the following table.

	Length.	Number of branch scars on exposed surface.	
First internodes	0,60	. . . . .	Incomplete node covered by pith cast.
Second "	1,80	. . . . .	Node partly covered by pith cast.
Third "	1,60	. . . . .
Fourth "	1,55	. . One	
Fifth "	1,55	. . . . .
Sixth "	1,55	. . One	
Seventh "	1,60	. . One	
Eighth "	1,55	. . . . .
Nineth "	1,65	. . One	
Tenth "	1,65	. . . . .
Eleventh "	1,65	. . One	
Twelfth "	1,65	. . . . .
Thirteenth "	1,85	. . One	
Fourteenth "	1,90	. . . . .
Fifteenth "	2,00	. . One	
Sixteenth "	2,10	. . . . .	Nodal line indistinctly shown.
Seventeenth "	0,50	. . . . .	Incomplete.
	26,75 cm.		

This example is remarkable on account of all the ribs on the exposed surface continuing over the nodes without showing a single case of alternation taking place. In



Text fig. 80.
Calamites approximatiformis STUR.
 Enlarged two times.

Text fig. 79.
Calamites approximatiformis STUR.
 Natural size.

fact, this specimen of *Calamites approximatifomis* shows the characters of the Genus *Asterocalamites* SCHIMPER and had this been the only example of the species known, it would certainly have been placed in that Genus, but the other specimens of *Calamites approximatifomis* show occasional alternations of the ribs at the nodes. The Scotch example however notwithstanding the non-alternation of the ribs on its exposed surface, is easily distinguished from *Asterocalamites scrobiculatus* SCHL. sp. by its distinct and prominent ribs with their large oval tubercles and the distribution of the branch scars.¹⁾

As already indicated, we unite with this species the *Calamites approximatus* STUR (non BGT.) as we fail to distinguish any character by which it can be separated from his *Calamites approximatifomis*, with which it seems to agree in every detail, as far its preservation admits of a comparison.

C. approximatifomis though possessing a likeness to some of the forms of *C. schützzeiformis*, especially to the *forma waldenburgensis*²⁾, differs from them in the constant occurrence of the non-alternation of the majority of the ribs at the nodes and in the presence of a large tubercle at their upper ends, as well as in the occurrence on some specimens, of smaller tubercles at their lower extremities. It further differs in the irregular disposition of the branch scars. *C. approximatifomis* seems to be a rare species.

DISTRIBUTION.

Austria.

Lower Carboniferous.

Ostrauer Schichten (STUR).

Horizon: Roof of the "Mächtiger Flötz".

Locality: Peterswald, Eugen Pit. (STUR's Pl. 5, fig. 4; our Pl. 141, fig. 1; K.K. Geolog. Reichsanstalt, Wien).

Horizon: Seam III. Liegendflötz.

Locality: Witkowitz, Tiefbau. (STUR's Pl. 4, fig. 7; our Pl. 141, fig. 2; K.K. Geolog. Reichsanstalt, Wien).

Horizon: ?

Locality: Jaklovec, Poln. Ostrau, Pit No. 5. (STUR's *C. approximatus*, Pl. 21, fig. 8; our Pl. 141, fig. 3; K.K. Geolog. Reichsanstalt, Wien).

Germany.

Culm.

Horizon: ?

Locality: Lauthenthal im Harz. (POTONÉ).

¹⁾ The specimen was given by Mr. THOMAS MACFARLANE, its collector, to Mr. J. S. CALDER, by whom it was presented to the Royal Scottish Museum, Edinburgh, in whose collection it is now preserved.

²⁾ The *Calamites approximatus* of authors. See p. 101.

Great Britain.

Calciferous Sandstone Series.

Horizon: Blaes above Broxburn Shale Seam.

Locality: No. 4 Roman Camp Pit, Uphall, Linlithgowshire. (Text fig. 79, 80). (Coll. Royal Scottish Museum, Edinburgh).

From a study of Calamitean pith casts, passing from those of newer to those of older Geological Horizons, it is seen that an intermediate Group exists, (See Section II, p. 188), on whose pith casts one can observe a gradual disappearance of the alternation of the ribs at the nodes, till in *Calamites approximatifomis* STUR, specimens may occur in which all alternation of the ribs at the nodes has disappeared from certain specimens or portions of pith casts when they may assume the characters of *Asterocalamites*.

On typical *Calamites* pith casts on which the ribs alternate at the nodes, only very rarely one observes one or two ribs to pass over the node without any alternation, but in the *Calamites* placed in Section II, this is a constant condition which is very well marked in some species where many of the ribs pass over one or more internodes without alternating at the nodes. This character is especially marked in *Calamites approximatifomis* where an alternation of the ribs takes place infrequently and as in the case seen at text fig. 79 and 80, not at all. Such a specimen is the last link in a continuous chain which connects the "Genus" *Calamites* with the "Genus" *Asterocalamites*.

Though these observations are only made on characters observed on the pith cast they show however a continuous and unbroken chain of gradual modification of the older character of the ribs passing straight over the nodes to a younger type in which the ribs regularly and almost invariably alternate at the nodes.

That the "Genus" *Calamites* is an altogether provisional one is clearly shown by the various types of fructification borne on Calamitean stems, but it is only in a very few cases that one can refer a Calamitean fructification to its parent stem and until this can be done in a much greater number of cases, to attempt, to split up the "Genus" *Calamites* would serve no practical purpose. This question however is dealt with more fully in the introduction.

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